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ELECTRICITY

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EDITORIAL NOTES.

A Novel Method of Submarine Cable Laying.

In view of our present hostilities with Spain, and at a time when the establishment of speedy communication between a fleet or army and the home government is of the most vital importance, a statement recently made by two well-known Englishmen at a meeting of the Royal United Service Institution in England is worthy of attention. These two gentlemen, whose names are Lieutenants William C. Crutchley and C. Scott Snell, and who are said to be experts in the science of military signaling, suggest that instead of relying upon the cables that may already be in existence for commercial purposes a naval commander might lay a number of special cables of his own. With the ordinary cable-laying apparatus now in use this would be an extremely difficult matter to accomplish expeditiously, and on this account Messrs. Crutchley and Snell are said to have devised a form of apparatus which may readily be fitted to any warship and will enable a commander to accomplish the desired result. The *Daily News* of London alludes to the device and describes the method of laying as follows:

"These inventors have devised apparatus by means of which a submarine cable can safely be laid at any rate of speed within the compass of the fastest cruiser. This is very far in excess of anything which has hitherto been accomplished, but there is little doubt that the plan is feasible. The apparatus is capable of being fitted to a warship or a properly equipped telegraph-ship, or, as an alternative, there is a temporary arrangement which is capable of being adapted to any vessel at very short notice.

"A pulley at the stern of the ship ejects the cable overboard, and is driven by a motor. Beyond this stern pulley is a wide drum, over which the cable passes on its way from the hold. In conjunction with the drum is maintained 2,000 feet of cable under a constant tension.

"The idea of a cable running out at twenty knots is rather startling, but experts are of opinion that this could be accomplished. The inventors have devised an apparatus for holding it in hand and completely stowing 2,000 cubic feet of cable, called the 'cable accumulator' (a small unit system of carrying the cable, which consists in placing the cable on board in drums of forty knots' capacity, and arranging them in columns, from which the cable is drawn off alternatively), an 'automatic traveler' to receive the cable as it leaves the drum, and finally a controlling system whereby an officer located in a chartroom keeps the attendant at the ejecting engine aware of the needed paying-out speed."

As will readily be seen, Messrs. Crutchley and Snell claim that by means of the apparatus they have invented, and in the manner in which the cable is coiled on board the vessel, it can be laid while the ship is running at twenty knots an hour, whereas heretofore under the most favorable conditions eight and one-half knots has been considered quick laying, it frequently being necessary even to reduce the speed to four knots. Another important claim made by these inventors is that a ship might place itself over a cable which lay in moderately deep water and transmit messages without making actual metallic contact with it, by means of induced currents. In support of this theory it was pointed out that messages have beeen transmitted and received by means of induced currents between a moving train and wires running along the track. In this case, however, the roof of the baggage car in which the receiving and transmitting instruments were located, and to which the receiver was connected, was of tin and practically insulated, and moreover, the distance between the car and wires was comparatively short. Whether intelligible signals could be transmitted by means of induced currents through any considerable depth of sea water, as is claimed, would seem rather problematical, and any experiment made along this line will unquestionably be watched with interest by the scientific world.

* * *

The War Tax on Telegraphic Messages.

From all accounts there would seem to be considerable uncertainty as to who should affix a tax stamp upon telegraphic messages. The Commissioner of Internal Revenue is said to be receiving scores of telegrams and letters from merchants, manufacturers and boards of trade, as well as from Senators and Representatives, asking his construction of the War Revenue Act of 1898 relating to this affixing of a stamp upon telegrams. The law apparently in no way specifies who shall affix the stamp, whether the sender of the message or the company, but simply imposes the tax of one cent upon each message and prescribes that "no telegraph company or its agent shall transmit to any person any dispatch or message without an adhesive stamp denoting the tax imposed by this act being affixed to a copy thereof, or having the same stamped thereon, and in default thereof shall incur a penalty of $10." In almost every case where a commodity has been taxed, and especially is this so in the case of proprietary articles, the consumer has been obliged to bear the whole burden of the tax, and in some cases even more than the tax, for where an article has called for a stamp of a denomination of less than a cent the consumer has been charged an extra cent. Undoubtedly the consumer should bear his share of the tax, but it scarcely seems just that the whole

tax, and in some cases even more than the whole tax, should be thrust upon him. In the case of telegraphic messages, where the tax is but one cent, why not have the sender affix a stamp when the message consists of ten words and the company agree to pay the tax when the message consists of over ten words. This arrangement would unquestionably favor the telegraph companies, but at the same time the patrons of the various telegraph companies would not feel that they were bearing the whole burden of the war tax on telegrams.

* * *

The Omaha Meeting of the American Institute of Electrical Engineers. The Fifteenth General Meeting of the American Institute of Electrical Engineers, recently held in Omaha, Neb., was probably one of the most successful gatherings ever held by that body in spite of the fact that but few Eastern members were present. The papers that were presented were with but few exceptions of a practical nature, which is certainly to be commended, as heretofore many subjects have been discussed at meetings of the Institute that were not, as a member once aptly expressed it, "within five miles of earth." Probably the most important subject brought to the attention of the members present was the preliminary report of the Committee on Standardization. This report, which was carefully compiled by seven electrical engineers of high standing, familiar with every branch of the electrical industry, has for its aim not only the standardization of the sizes of apparatus, but also includes all the definitions and terms usually met with in electrical specifications, as well as suggestions for standard methods of making and recording tests. The first subject touched upon in the report is that of "efficiency." After defining the term and stating how the electric power should be measured for various types of machines and on transmission lines, the question of the rise of temperature is taken up and rules laid down as to how and where such temperature should be measured. Insulation and dielectric strength are next touched upon, and rules given as to where all insulation resistance tests should be made. The regulation of apparatus is fully discussed, and rules laid down as to how it should be measured. The variation and pulsation, rating and classification of voltages and frequencies are all carefully dealt with. The report ends with the recommendation of an already fairly well standardized notation. Although the recommendations regarding the standardization of apparatus were quite fully discussed at the Omaha meeting, no definite action was taken toward its adoption. It would be well were some such uniform standard generally accepted internationally, and it was possibly with some such object in view that definite action was deferred for the time being.

* * *

Average Earnings of Street Railways in 1897. The 1898 edition of the *Street Railway Journal's* financial supplement, which has just appeared, contains a careful comparison of the gross earnings of the principal American street railway properties for 1896 and 1897 which we think should prove of interest to our readers as furnishing a means of judging to some extent of the prosperity of the country. During times of unusual business depression, or in what is familiarly known as "hard times," the gross earnings of street railway companies are as a rule affected, and a careful comparison of the gross earnings of a number of street railway companies extending over a period of several years will usually afford an excellent thermometer whereby to judge of the financial condition of the country. According to the figures in the "Street Railway Red Book," of 175 American street railway properties the Union Traction system of Philadelphia leads in gross earnings with receipts aggregating slightly less than ten and a half millions, or with a gain of only $270,620 in gross receipts over 1896, or 2.65 per cent. In the group in which the Union Traction system is to be found, numbering twenty-six systems in all, i.e., those properties earning one million dollars or more annually, there was but an average gain of 2.2 per cent. in 1897 over 1896. In the second group, comprising nineteen roads earning from $500,000 to $1,000,000, there was a decrease in gross earnings of 0.11 per cent. in 1897. In a third group, comprising 46 properties earning from $100,000 to $500,000, the gross receipts increased as a whole 1.87 per cent. in 1897 over 1896. In the smaller systems the variation in gross receipts between 1896 and 1897 was very slight. The average in gross earnings of the whole 175 properties shows an increase of but 1.9 per cent. in 1897 as compared with 1896. It is interesting and rather surprising to note that the average increase in gross earnings of all these properties was less between 1896 and 1897 than between 1895 and 1896. This falling off in average gross earnings in 1897 may partially be accounted for in the growing use of the bicycle for business purposes and to the slow recovery of industrial activity among the masses of the people. Under the present existing conditions in this country, it would not be surprising if the average gross earnings for 1898 should be even less than for 1897.

Under the Searchlight.

Notes and Comments on Various Topics.

The Proposed Reduction in G. E. Stock.

The Boston *News Bureau* of July 6 says:

The General Electric preferred stock committee has considered the proposal of the directors of the General Electric Company to reduce the stocks of the company, both preferred and common, 40 per cent. to $60 par value, and a majority of the committee has decided not to recommend this proposition to the preferred stockholders. Mr. Carr, the minority member of the committee, representing the Ames estate interest in the preferred stock, was in favor of accepting the proposition. The Ames stock, therefore, not having been deposited with the committee, will probably be voted at the meeting of the General Electric stockholders in favor of the proposition to reduce the stocks of the company to $60 par value. Messrs. Livermore and Atkins, the majority of the preferred stock committee, will shortly issue a circular outlining their proposed action in regard to the preferred stock. Mr. Carr will withdraw from the committee.

As we stated in an editorial in our June 22 issue, there would seem to be no valid reason why the preferred stockholders should be obliged to bear practically the whole burden in the proposed reorganization of the General Electric Company, which has been brought about through the efforts of ELECTRICITY. That a reorganization is absolutely necessary we have claimed and proved for several years, but it is likewise plain to be seen that if the accumulated dividends, now amounting to $1,488,200, on the preferred stock, are paid it will wipe out all the earnings of the General Electric Company for this year, and consequently no dividends need be looked for next year, and possibly for several years to come. No account has been taken of these back dividends, and in the annual reports issued by the General Electric Company the accumulated dividends have systematically been omitted from the list of liabilities, which, as we have all along claimed, is decidedly wrong. ELECTRICITY has pointed out to the directors time and again that these accumulated dividends were a liability which would some time have to be met. Were we preferred stockholders, we should unhesitatingly side with the majority of the committee and oppose the reduction of the preferred stock in the manner proposed.

* * *

IN a scrimmage between employees of the Monmouth Traction Company and those of the Pennsylvania Railroad Company at Bordentown, N. J., on the 8th inst., about the raising of a pole on disputed ground, an incident occurred that will probably be utilized by some of our realistic playwriters as an effective scene in an East Side drama. The particulars as we find them in the Pennsylvania *Inquirer* are as follows: "When the trolley men prepared to raise the pole Mayor James S. Gilbert appeared with Marshal H. N. Jobes and twenty-five officers sworn in by him and gave warning that any one interfering in the work would be arrested. The street was crowded with people. The railroad company also had a big force on the scene. The raising of the pole alongside the hole was the signal for both forces to come together. Railroad men jumped into the hole and were yanked out by the trolley men. Supervisor F. J. Potter and his assistants, Richard Silvers, Joseph Venable, Frank Eldridge, James Lewis and Edward Ford, all Pennsylvania Railroad employees, were arrested and taken to the City Hall. Later they were released on an order from Justice Garrison, of Camden. In the meantime the trolley men had conquered and the pole was planted. The railroad men then undertook to saw it down, and in the scrimmage Marshal Jobes and James Lewis were slightly cut by the saw. Then a Monmouth Traction man was seized with a happy thought and climbed to the top of the pole with an American flag. He remained on his lofty perch for nearly three hours and dared those beneath to cut the pole down, but no one attempted to do it. Late in the afternoon, however, the pole was ordered removed by Councilman Thomas Gash, chairman of the Street Committee. It was moved a distance of several feet to another property, the committee claiming after an examination of the ordinance and a measurement of the street that the pole was erected in the wrong place. It now stands in its rightful position."

* * *

WE are in receipt of the following notice:

TWENTIETH TRIENNIAL EXHIBITION.

Office of the Executive Committee, Mechanics Building.

Boston, May 27, 1898.

It is well known that the General Electric Company do not place exhibits with local expositions. Assured of the high character of our October exhibition, they will present a large working exhibit with us.

MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION.

Possibly the "working exhibit" referred to will show the visitors at this exhibition the General Electric Company's method of manufacturing stocks and bonds at will.

* * *

Peculiar Antics of a Lightning Bolt.

During a severe thunderstorm on July 5 the home of a certain gentleman in California was struck by lightning. The bolt struck a big locust tree in the yard, jumped from that to the peak of the house and burned or melted some nails in the wood. From there it went down the attic window post, which was splintered, and went through the plastering in five small holes. It looked as though the holes were made by a gun. It set the lace curtains on fire and partly burned a feather bed. The bolt seemed to part here, part going out front and part going back. The part going front damaged the shutters, ripped off the plastering, followed some nails over the door-head and melted the wire on a screen door and went into the ground under the front steps. The part that went the back way doubled again before it entered the ground, one part taking one side, tearing out a window frame, following a tin valley down a doorway, ripping off plastering and laths and then into the ground. The part that took the other side ran along a partition, ripping off laths and plastering, down the back stairway and through a tin safe or cupboard. In the cupboard were knives and forks. These were melted and stuck where they came in contact with each other. From the cupboard it went through the corner of the house, tearing off plastering and weather boarding and ripping open the corner posts.

LACHINE RAPIDS PLANT AND THE COST OF PRODUCING POWER FOR GENERATING ELECTRICITY THEREFROM.*

BY W. M'LEA WALBANK.
Montreal, Can.

In order to allow of a fair comparison with other plants, of the cost of producing power for generating electricity from the Lachine Rapids plant, the writer considers it desirable to give you a brief outline of the hydraulic as well as the electrical equipment of our works.

The world renowned Lachine Rapids, as you are all doubtless aware, is situated on the St. Lawrence River, a short distance from the city of Montreal.

The idea of converting the wasted energies of these turbulent waters and harnessing them for the use and convenience of man was not new. As far back as 1866 a company was formed whose object was to erect dams and construct large hydraulic works about a mile lower down the river than the site of the present power house, their object being to induce factories to establish their works at the rapids, for at that date the possibilities of electric transmission had not been demonstrated. The scheme, however, never materialized, and since that date various projects have from time to time been talked of, but never matured.

In the fall of 1895 the Lachine Rapids Hydraulic & Land Company, Ltd., commenced its operations. The directors commenced work only after having fully satisfied themselves upon the difficulties to be encountered and overcome, and carefully studying the question of back water, frazil and anchor ice, and went in with a determination to succeed.

The company was honestly formed, without "ground floors" or "sub-cellars," with a bona fide capital in which every share represents one hundred dollars ($100) cash. This, the writer considers, has direct bearing on the cost of producing electricity, because a company handicapped by what is called watered stock, or exorbitant promoter salaries, has to pay interest on money it never had the use of.

Having therefore formed a company on a solid and firm financial basis, the property fronting on the Lachine Rapids, and controlling the water power privileges, was secured, and operations for the development of the water power commenced.

HYDRAULIC DEVELOPMENT.

The hydraulic plant consists of a main dam and power house, one thousand feet long, and a wing dam and guard pier five thousand feet long, forming a head race or basin with an average depth of twelve feet at low water.

To secure this it was necessary to divert the waters of the St. Lawrence and lay bare the bed of the river for a distance of over a mile and remove over 400,000 cubic yards of rock.

The main dam, which is constructed of a series of isolated cut stone piers, with head gates and stop logs, furnishes in all thirty-six (36) flumes and three (3) waste weirs, at the same time forming foundations for the power house and turbine sheds.

The total development will, when completed, consist of seventy-two (72) vertical turbine wheels and twelve (12) generators, the wheels connected in series of six, by gearing, to a horizontal shaft, at the end of which a generator is directly connected. The completed power house will contain twelve (12) such sets.

Of the total installation forty-eight (48) wheels are already in place, and the power house, head race, tail race and dams are completed.

ELECTRICAL EQUIPMENT.

Each dynamo house will contain four (4) three-phase General Electric alternators, wound for 4,400 volts at full load, and two direct-current exciters at 120 volts. There will be in the total installation three such dynamo houses, containing in all twelve dynamos and six exciters, each exciter being capable of exciting four machines. Each dynamo house will have its own switchboard, of blue Vermont marble, of the very latest design, so arranged that each circuit may be operated from the switchboard of either power house. The floors are of slate and the building of solid brick. The current is generated at 4,400 volts, avoiding the use of step-up transformers, is transmitted on iron poles over bare copper wire to the city of Montreal, a distance of about five miles, to the sub-stations, where the pressure will be lowered to 2,300 volts, and by means of sub-station switchboards sub-divided into the desired units and distributed partly through underground conduits, and partly by overhead construction, throughout the city of Montreal and its suburbs, where we find a population of over 300,000 people offering a market for light and power.

Of the total equipment one-third is already installed.

TOTAL POWER.

The wheels were tested at the Holyoke testing flume on April 16 and 17, 1897, and developed at full gate as follows:

With a speed of 76¼ revolutions, discharging 235.33 cubic feet of water per second and developing 300.84 horse power, showing an efficiency of 81.32 per cent., which would make the total possible output of our power house about 16,000 kilowatts.

COST.

Perhaps the greatest obstacle to a fair comparison of electric current produced by water power, as against the same current produced by steam, is the first cost. In the former case, especially if a large water power is to be developed, the expense of the whole installation, such as dams, head and tail races, etc., has usually been made at the commencement, while perhaps only a fraction of the power thus obtainable is at once used, therefore throwing a very much larger capital cost per unit than with a steam plant, which need only install the power necessary for immediate demand and continue increasing or adding thereto as the demand therefor offers.

In our own case you will notice it was necessary for us to spend about one million dollars ($1,000,000) in hydraulic development. This million dollars is able to furnish us over twenty thousand (20,000) horse power, whereas it will be some time before we will be able to convince the public of the advantages to be derived from the use of electricity, which is no easy task, as anyone familiar with the subject will bear out.

The 5,000 horse power from a commercial point of view will have, for the present at least, to be charged with all the expense of the hydraulic development of over 20,000 horse power.

In estimating the cost of producing power from the Lachine Rapids, the writer does not take into consideration the cost of distributing power, for this would be the same in either case, whether the prime mover was a water wheel or a steam engine. He will therefore confine himself to the cost of developing water power and delivering that power on the bus-bar at the sub-station, exclusive of the generator. He will add the cost of transmission line from the source of power to the sub-station in the city, because this is directly attributable to water power plants, as it would not be necessary in the case of a steam plant, unless it were for transmitting power from a coal mine to a city, or following the practice laid down by the Brooklyn Edison Company, in locating their power house at a point convenient for obtaining coal and water at reduced prices, using high-tension transmission, and converting by rotary converters at various sub-stations.

There will also be included the step-down transformers to bring the pressure equal to that required for local distribution, namely, in the neighborhood of 2,000 volts.

He will also charge the water power with the drop or loss in power from the rapids to the sub-station.

The writer therefore considers, in justice to the Lachine Rapids plant, it would be necessary to give, first, the cost per kilowatt per year for the portion of the plant at present installed and connected to generators ready for operation, and second, what the cost will be per kilowatt per year when the whole water power development is in operation.

First—The total cost of water rights, dams, hydraulic machinery, power house, transmission line, step-down transformers, etc., is $957,200.

Power developed, 4,000 kilowatts at the generator. Allowing 10 per cent. loss, there will be delivered at the sub-station bus-bar 3,600 kilowatts, which is equivalent to $263.83 per kilowatt, capital cost.

This, at 6 per cent., would be equivalent to	$15.95 ꝑ KW.
Depreciation of $300,000, which will more than cover the cost of that portion of the plant subject to depreciation, rated at 5 per cent. and spread over 3,600 kilowatts, would be equivalent to	4.17 ꝑ KW.
Operating expenses, including labor, repairs, insurance, amounts to $10,275 per annum, which, divided into 3,600 kilowatts, is equivalent to	2.85 ꝑ KW.
Making a total cost per kilowatt on a twenty-four hour day basis, per year	$22.97 ꝑ KW.

Second—The total cost per kilowatt with the whole water power plant in operation.

Before giving these figures the writer would like to explain that the figures herewith quoted are reliable for the cost of the completed plant, inasmuch as the same is at present under contract with reputable firms, the Lachine Rapids Hydraulic & Land Company having a limited time in which to order the works completed.

The total capital cost with seventy-two wheels installed will be $1,113,273.

Power developed after deducting all losses will be 13,500 kilowatts at the sub-station bus-bar, equivalent to $82.46 per horse power capital cost, which, at 6 per cent., represents (per annum)	$4.95 ꝑ KW.
Depreciation per kilowatt will equal	1.68 ꝑ KW.
Operating expenses, including labor, repairs, oil and waste and insurance, if taken upon the same basis as already existing, will amount to $20,453, equivalent to	1.51 ꝑ KW.
Making a total for a twenty-four hour run per annum of	$8.14 ꝑ KW.

It will be noticed that the operating expenses, as well as the depreciation per kilowatt, in the latter case is very much reduced, and it is a remarkable feature how constant our operating expenses are, even at present, being practically the same with full load as with no load.

In connection with these figures it might be stated that coal used in Montreal and vicinity is what is known as Nova Scotian coal and costs $3.50 per ton for run of mine.

The writer would also draw your attention to the fact that the capital cost cited in each of the foregoing cases includes money paid for real estate, of which the company owns over some eight million feet, fronting on the rapids, intended at some future date to form the site of a suburban town, and which it is hoped and expected will return the money expended in developing the water power above referred to.

CONCLUSIONS.

From the foregoing the writer trusts that he has shown that where reliable water power can be ob-

* Paper read before the National Electric Light Association at its Twenty-first Convention, Chicago, Ill., June 7, 8 and 9, 1898.

tained within reasonable distance from power centers it can be made to produce cheap electric current, to say nothing of the great advantages the city must derive therefrom, not only commercially, but viewed from a sanitary standpoint as well, as the use of electric power thus generated is the best smoke consumer yet invented.

TRANSFORMER ECONOMY.

BY PROF. WINDER ELWELL GOLDSBOROUGH,

Purdue University, Lafayette, Indiana.

A great deal has been said and written about the static transformer of alternating currents, and yet we are only just beginning to understand this much discussed piece of apparatus. The manufacturers have made it and experimented with it, the theorists have experimented with it and disputed over it, the underwriters have disputed over it and endured it, and the central station men have endured it and made use of it to the great good and comfort of the public. No other piece of apparatus in the field of electrical engineering has been lauded higher or been the subject of greater abuse, and to all it has served a purpose.

To-day the transformer occupies a higher position than ever before, and it grows in importance as each new development in the field of applied electricity points out a new department of usefulness for it.

There has, however, been enough agitation lately on the part of manufacturers, in behalf of substituting new types of transformers for the old ones now in use, and of relegating the small transformer to the scrap heap, to cause the central station men, who are responsible for the successful operation of alternating current generating plants, some unrest. The foundations of many of these plants were laid before the time of skilled designers of electrical machinery, and at a period when the factory motto was "cut and try." As the public demands increased, the plants developed and expanded before the practical men were amenable to "theories," and before the exact methods of the laboratory had become the daily practice of the constructing engineer. Managers see that engineers are still making mistakes, and that faulty design is still a factor in electrical development, and when they call to mind the enormous sums of money that have been spent in this country on ill-advised improvements it is not to be wondered at that they hesitate.

There is, however, a gradual change for the better in the number of the yearly contributions to the records of our electrical societies, and as these records are the expression of the best thoughts of the men who have made America famous as the land of electricity, they may be taken as signs of the times in our department of engineering activity.

We are constantly impressed with the fact that the refinements of exact scientific methods are being made the subject of everyday discussion, and that the more difficult problems of the technical side of the profession are being so well elucidated by our "practical theorists" that it is possible for all of us to enjoy a concrete appreciation of electrical science without an excessive expenditure of mental energy on the theoretical.

We are coming to a time when exact methods will be the universal rule and when the reputation of having a high "guessing factor" will no longer be a sufficient recommendation.

These influences are noticeable in the improved electrical intelligence of our workmen, as well as of our station engineers, and I find that it extends even to the general public. Indeed, a careful record of the number of times that I am asked "how does the little trolley wheel push the car along?" shows a yearly decrease of nearly 50 per cent.

So we see that matters adjudged to be of slight importance a few years ago are being allotted their normal position. A fault is a fault at the present day, and is not often disregarded as "too small to be appreciable." The old saying that "if you take care of the pennies, the dollars will take care of themselves" applies just as well to electrical engineering as it does to other professions, and it is the "pennies" that I am about to deal with.

Our principal manufacturing companies freely advertise and guarantee the specific economic performance of which each and every one of the transformers that they place upon the market is capable. They severally advertise to supply us with transformers equaling in efficiency, regulation (and what not) any other transformer that can be found upon the market.

The manufacturing companies are unanimous in their guarantees of high efficiency, low core losses, negligible aging and close regulation. If we can purchase transformers freely on these representations, with sufficient guarantee that the specifications advertised are strictly conformed to or improved upon, there is little to be desired on the part of the purchaser over and above what is offered. Any slight improvement that it shall be possible to make upon the best of the performances advertised by the competing factories will be forthcoming in consequence of the rivalries of trade, and the purchaser need only seek now for means of protecting himself against occasional faulty manufacture.

When, therefore, we consider the perfection to which this type of apparatus has been brought, in its every detail, and in sizes varying in capacity from a fraction of one to over 800 kilowatts, we have cause for congratulation.

If you have followed the design and manufacture of the commercial transformer, I think you will admit that at the present time the best of them are figured just about as close as is possible, and in fact we have almost reached the point beyond which any further advance in the direction of improved efficiency must be made by getting better insulating materials, requiring less space and giving this space to the iron and copper.

With a view to investigating the present status of the transformer and the ability of transformer manufacturers to meet in all cases the exacting specifications which they have laid down for themselves, I have had a number of transformers of recent design tested in the Purdue laboratories within the last year. The results of these tests are especially gratifying when gauged from the standpoint of our present commercial requirements, and to the specialist a detailed statement of the results would be interesting. In view of the fact, however, that the electrical literature of the day contains numerous matters of this kind I will not bore you with many figures, but rather discuss the results in a general way.

With but one exception the transformers tested have surpassed the requirements of the specifications laid down by Prof. Jackson in his excellent article on transformer testing, with which we are all familiar, and generally speaking they have conformed fairly closely to the published guarantees of the companies submitting the transformers for test. To what extent this is true may be better appreciated if I cite one or two examples.

A 2.5 kilowatt transformer was submitted for test that was guaranteed to conform or improve upon the following specifications: Core loss 48 watts, regulation 2.1 per cent., and full load efficiency 96.1 per cent. The test of this transformer gave: core loss 42.19 watts, regulation 1.9 per cent., full load efficiency 96.2 per cent.

The showing made by this transformer is good. The core loss is 5.81 watts less than the stipulated value, and the efficiencies are in excess of the stipulated values. In this case the manufacturers more than substantiated their guarantee, and supplied a transformer that is a greater revenue producer than the specifications call for. If the core iron of this transformer can be relied upon as not materially increasing in its hysteretic loss with age, it is an easy matter to figure the money value of the excess economy that the transformer develops.

Suppose, for instance, a contract should be made for forty of these transformers at $30 each to meet an increase in a station load of 100 kilowatts. On an all-day schedule these transformers would probably carry a commercial load equivalent to full load working for five hours. This assumption may seem to represent a better condition of service than is usually met with in practice, but it is an assumption that is fair to the manufacturer in considering the all-day efficiency. The transformers would therefore be working under no load for 6,935 hours and under full load for 1,825 hours per year, and under the conditions of the test would save 1,794 kilowatt hours to the station. If we figure the cost of producing this power at two cents per kilowatt hour, the saving per year would be $35.88 for the forty transformers, or practically 3 per cent. on the amount invested in the transformers. If this power were sold for six cents per kilowatt hour it would represent a net gain to the purchaser of $1,794 \times .06 =$ $107.64 per year more than he had any right to expect under the contract specifications.

Another 2.5 kilowatt transformer submitted for test is advertised by the makers to show a core loss of 57 watts, a quarter load efficiency of 91 per cent., a full load efficiency of 96 per cent., a regulation of 2 per cent., and a no load current of .1 ampere. Under test it was found to have a core loss of 63.6 watts, a quarter load efficiency of 90 per cent., a full load efficiency of 94.8, a regulation of 3 per cent. and a no load current of .087.

Suppose we estimate the economy of transformers of this type just as we did those of the type previously considered. The forty transformers, working on the same schedule, would waste 4,014 kilowatt hours more power than they should under the specifications advertised. At two cents per kilowatt hour the total money loss would be $80 per year, or over 6.5 per cent. of the cost price of $1,200.

Many engineers may claim that the cost of checking up the performance of the transformers would more than eat up the saving effected by the small margin that these results represent, and in many cases under the present organization this would doubtless be true, but if a well-advised stand was taken by the central station managers for mutual protection the result would be markedly beneficial.

A percentage of the transformer output of each of the manufacturing firms could, for instance, be tested in some one place, where a record of the individual performance of all the transformers submitted for trial could be kept, and not only efficiency, but aging and insulation and temperature trials could be made at a merely nominal expense.

But these examples do not cover the ground. I will cite two others.

In the case of a 15 kilowatt oil insulated transformer, guaranteed to develop a quarter load efficiency of 96 per cent., a full load efficiency of 97.4 per cent. and to have a regulation of 1.77 per cent., the test showed a quarter load efficiency of 94.5 per cent., a full load efficiency of 96.1 per cent., and a regulation of 1.6 per cent. The core loss of this transformer, which operates at 60 cycles, is 186.6 watts, and the specifications under which it was built require that the core loss should be about 150 watts.

It would take seven of these to give an output of 100 kilowatts—and they would cost not less than $115 each. The seven transformers in this case would waste 3,855 kilowatt hours in a year, which represents a financial loss of $77 in one year over and above the loss to be expected. This approximates 10 per cent. of the original cost of the transformers and is an item that cannot be neglected. If, on the other hand, this waste power could be sold at

* Paper read before the National Electric Light Association at its Twenty-first Convention, Chicago, Ill., June 7, 8 and 9, 1898.

six cents per kilowatt hour, it would represent a part of the just return on the investment contemplated when the transformers were purchased, and would mean $221 to the company.

I do not claim that the figures which I present to you cover all the items of expense that enter into the installation of 100 kilowatts—in transformers. They do not, but they do represent a phase of the question that deserves more than passing attention at a time when competition is becoming sharper and sharper.

In what I have so far said I have not touched upon the matter of the aging of the transformer core-iron. In cases where it is appreciable it only serves to aggravate the conditions and make the percentage loss greater. In the same way the cost of production and the selling price of the power both enter as important factors, as well as the cost of the transformers. All of these assumptions I have placed low and they should be regarded rather as pertinent examples of the conditions that exist in large plants. The small plants will be affected by influences of this character to a much greater extent.

I do not wish to tire you with figures, but as I believe you will be interested in these comparisons of guaranteed and actual efficiencies, I wish to call your attention to one more case before leaving this matter. Not long ago a manufacturing company requested permission to send a one kilowatt transformer to the University laboratories for a special test, as the transformer was of a new type and highly efficient. There was no direct guarantee in this case, but the impression was given that the transformer would develop an efficiency equal to, if not exceeding, the efficiency of any other transformer of like capacity on the market. The results of our tests indicated a core loss of 178 watts, a full load efficiency of 82.6, a quarter load efficiency of 62.4 and an all-day efficiency of only 54.5 per cent.

There are probably to-day a goodly number of these so-called "highly efficient" transformers eating up the profits of various of our lighting companies throughout the country, simply for the reason that in many cases business managers of electric light and power plants are not sufficiently alive to the importance of looking after the efficiency of the apparatus forming their equipments just as closely as they look after and check up every item of operating expense and maintenance that is necessitated by the exigencies of the service.

The use of transformers such as the one just referred to would be pitiable. It is fortunate that they do not grow to large proportions, but nevertheless they have a telling effect wherever they fall.

As regards the aging of the modern transformer irons, I hold rather a conservative opinion at the present time. A great deal has undoubtedly been accomplished within the last few years in the way of improvement in this respect, and the modern transformers that are supplied to us for testing show a wonderful gain in efficiency, due both to the lower initial core losses and to the diminished per cent. of these core losses with the aging of the iron.

The general opinion seems to prevail at present to the effect that aging is due directly to the reversal of the direction of the flow of the magnetic flux in, rather than to long continued heating of, the iron forming the cores of transformers, and this opinion is also expressed in much of the printed matter that has come into my hands.

In a lecture delivered by Prof. Fleming he said: "It was also discovered, some time back, by Mr. W. Mordey that prolonged slow heating of iron to only 60 degrees C. or 90 degrees C. has a marked effect on the hysteretic constant, and the result is often to increase this constant two or three times. The effect varies with the annealing of the iron, and in many cases the iron which shows the least hysteretic constant at starting experiences the largest percentage increase of it on prolonged heating. This effect is called the magnetic aging of the iron. Owing to the enormous use of iron for transformer purposes this aging had now become a very important matter.

"The electrician lays no very great stress on the mechanical qualities, such as tensile strength, elasticity and so on, but he requires high permeability, small hysteretic constant and small aging; and the iron and steel manufacturer has been able of late years to meet these new requests by producing steel of the necessary quality. Iron and steel can now be produced with a maximum permeability of 4,000 C. G. S. units, a hysteretic loss of about .15 watt pound per 100 cycles per 2,500 flux density, and of non-aging quality. I do not mean to imply that all these qualities can be equally combined in the same sample, but that the iron or steel can be varied to suit the demand.

"Steel can be produced with a higher permeability than wrought iron for large magnetic forces, and with a superior non-aging quality."

The fact seems to be well established that non-aging transformer iron is a commercial possibility, but the fact remains to be demonstrated practically that material of the necessary quality can be obtained in sufficiently large quantities to supply the demands that are being made upon the manufactories.

Failure in this regard is not the fault of the builders of the transformers, and I have reason to know that there are cases in which disquiet prevails in the minds of managers as to whether or not they are getting what they are paying for. I know that the general claim is made that iron with an "inappreciable aging effect" is used, and I do not wish to go on record as claiming that it is not used, but what I do wish to point out is that there are transformers being placed on the market to-day that do not contain non-aging iron. From a large transformer company I have received notice that "at the present time we have not non-aging iron which will fulfill our specifications of core loss; that which we have on hand will give a core loss of from 20 to 25 per cent. greater than the amount stated in our specifications." At the present time therefore it is needful to make just as careful tests for aging as for efficiency or for insulation, in spite of the fact that the former take a longer time and are therefore relatively more expensive to make.

During the last three months six transformers of different types have been subjected to most carefully conducted aging tests in our laboratories. The completed report on these tests has come to me within the last few days and I can give you a resumé of the results.

The core losses of transformers A and B were high to begin with, the first being 72 watts and the latter 83 watts. The per cent. increase in the core loss of these two transformers does not, however, seem to be as great as the per cent. increase in the core losses of transformers C and D that are of more recent manufacture, and that showed initial core losses of 31.5 and 37 watts respectively.

Transformers B and D are of 1.5 kilowatt capacity and transformers A and C of 2.5 kilowatt capacity. An increase of from 5 to 10 per cent. is shown in all the transformers.

To get an idea of what this means, suppose we consider the effect upon the economy of the 2.5 kilowatt transformers, considered in the second case discussed above of a 10 per cent. increase in the core loss. It will add $1.11 per year to the cost of operating each transformer at two cents per kilowatt hour, or $44.4 for the total number.

This represents an additional gain of 3.7 per cent. per year on the investment in three months, or a possible percentage loss on the investment of 14.8 per cent., after the first year, on the supposition of a uniform increase in the core loss.

These figures are not startling in any way, they are too small for that, but they are matters of fact to be taken into consideration when making investments. The opinions that I am voicing regarding the aging of modern transformer irons are conservative, as I believe the transformers built to-day will show a marked improvement upon the performance of transformers built even as late as one year ago. As far as the aging tests that we have made go to throw light upon the subject, I am inclined to believe that the aging problem has as yet not been solved, as none of the transformers tested have met the requirements of the specifications under which they were submitted, and some have fallen very far short of it. All of the transformers tested were new except transformer A, which at the time these tests began had a core loss already increased to 13 per cent. above its initial value. Transformer A was built about two years ago.

The aging of transformer iron does not increase at a constant rate with the time. The rate of increase diminishes as the service continues, but the increase may go on indefinitely. Until the use of non-aging iron becomes more generally possible than at present, it is probable that it will pay to replace the majority of the transformers placed on market by new ones every few years.

It is our present intention to inaugurate next fall a series of one year aging tests under continuous full load conditions of a representative number of transformers that will be built during the present summer by the manufacturing companies who are interested in having these points thoroughly ventilated, and I trust to be able to publish a record of fine performance in this respect at the time of the completion of the tests.

The correct insulation of transformers is another important point that should be considered by the central station manager. Like many of the problems with which we have to deal in the effort to make the transformer a commercial success, this one seems to be subject to a wide variety of opinion. The oil insulation of transformers has deservedly come into great favor, and where care is taken in the selection of the oils used and in the proper design of the transformer case, high protection is secured. Oil insulation under all circumstances does not, however, secure to the purchaser the protection which he feels he is paying for. The claims that are usually made for the superiority of oil insulation, to wit, that it serves to preserve the insulation from oxidation, reinforces the resistance of the insulation to puncture, reinsulates punctures after the passage of the discharge and facilitates the diffusion of the energy liberated as heat in the core and the coils, can in general be readily substantiated.

My experience, however, is that these statements must be regarded as having only a relative bearing upon the subject. Under certain circumstances the insulating value of an oil will be very materially impaired. We are told that transformers will last indefinitely when insulated with oil, whereas without oil the insulation will be so deteriorated after five or ten years that the transformers should be placed, and it may therefore be a matter of surprise that the insulating qualities of the oil itself are ever seriously diminished. As a matter of fact experiment shows that the insulating properties of the oil commonly used in transformers are increased as their temperatures are raised up to about 110 degrees C., and that if allowed to cool they will not lose their augmented power of resisting a disruptive discharge. This much might be said in favor of oil insulation, in view of this two or three fold gain in insulating power, were it not for the fact that a continued heating of the oil for any considerable length of time changes the oil to such an extent that on being cooled its break-down value will be only about one-fifth of its original value. And therefore an oil insulated transformer that will stand an insulation test of 10,000 volts when new, may break down under a pressure of 2,000 volts after having been in continuous service for a considerable time. Conditions such as will produce a result of this character

are not likely to occur in the case of modern transformers, as the increase in the temperature of even the poorest transformers rarely exceeds 70 degrees C. I have, however, met with cases in which excessive heating has resulted when the transformers were kept continuously in service, and I have also in mind a case in which a good modern transformer was so situated above a tin roof and in a position where it was protected from any breeze that might be stirring, that, when the sun played upon it, its temperature reached perfectly distressing values.

What I have said will serve as a hint of how not to handle a transformer, and the importance of selecting proper places for the location of transformers.

If you will look carefully into the matter you will find that not all of the burnouts are due to faulty construction on the part of the manufacturer. It is my experience that the contractor has been in fault in a fair proportion of the cases in which the transformer and service installation has suffered.

For all commercial purposes the best oils will be found to give thoroughly satisfactory results and retain their insulating properties unimpaired so long as the maximum temperature of the oil does not exceed sixty or seventy degrees centigrade. In making a station test of a transformer, if the rise in the temperature of the windings, as measured by the increase of resistance method, does not exceed fifty degrees centigrade after a ten hours' run at full load, the transformer may be passed as satisfactory in this respect.

In connection with oil insulation it must be remembered that its efficiency as an insulating medium is impaired by discharges in the oil. One of the foremost claims made in behalf of oil insulation is that it will flow in and fill up a rupture in the insulation of the coils. Every electric discharge that takes place through the oil, however, disintegrates and breaks up the normal structure of the oil, and causes carbon and other conducting compounds to form. These will rapidly multiply if the discharges are at all frequent, and will destroy the insulating properties of the oil.

As a case in point, and I presume you may know of other similar instances, I want to call your attention to a very good example of what good practice vs. bad practice will accomplish.

There is a city in the West in which the conditions under which electricity is supplied for incandescent lighting are somewhat unusual. There are two companies interested in the business, and both employ the alternating current converter system of distribution. The plant that is operated by the older company was installed about six years ago, and its equipment has grown slowly from year to year as business expanded. Its development has followed the waves of evolution modifying electric lighting practice within this period with a lag factor approximating 90 degrees. The plant has some strictly modern machinery, but much of the line equipment is old. A number of its transformers have been burnt out on account of defective insulation, some have been burnt out by lightning and some have shown their efficiency by getting so hot when switched in on an all-day schedule, under light load, that the "oil used to insulate them boiled up and over and ran down the outsides of the cases."

It is needless to say that in the latter type of transformer the hysteretic losses were considerable; the transformers were, however, manufactured by a firm of high commercial standing.

The lines of the old company are not protected by lightning arresters except where they enter the station, and the secondaries are not grounded.

The new company has been in operation two years and its plant is thoroughly up to date and highly efficient. Oil-insulated transformers of from 80 to 200 lights' capacity are used, and are kept in continuous service. The transformers are of modern design and stand an insulation test of 7,000 volts, without oil. The lines of the new company run over those of the old company and are protected about every 1,500 feet by lightning arresters. None of the secondaries of these transformers are, however, grounded, and magnetic shields are not used. The new company has never experienced any trouble from burnouts of any kind, although its lines are very much exposed. In a very violent electric storm which occurred some time since, in which the service of the old company suffered in consequence of transformer burnouts, the service of the new company was not interfered with in any way, although lightning struck its lines several times.

There has been a great deal of interest expressed recently in the effort to formulate a definite set of specifications covering the construction and insulation of transformers, with the end in view of decreasing the fire hazard and supplying the necessary protection from loss of life and property to both the producer and consumer of electrical energy.

In a letter that I have lately received from a gentleman who is much interested in the success of this project, he says that after corresponding with a number of makers, engineers and lighting companies to obtain suggestions as to the remedies for the troubles arising from crosses, lightning, insulation, break-downs, etc., the results were very unsatisfactory, as there seemed to be a vast difference of opinion.

I have read a great many articles for and against the use of earthing devices, grounded shields and grounded secondaries, but I am yet to be convinced that the prominent American practice of high insulation resistance to a disruptive discharge and a plentiful use of well-grounded short air-gap lightning arresters, does not give a sufficiently good protection.

As I have already remarked, the number of modern transformers that are reported as burning out is relatively very small. By far the greater portion of the troubles arise from crosses between the high and the low potential circuits, and in such cases the loss must be attributed to faulty installation and not to any imperfection in the transformer.

An oil insulated transformer for use on 2,500 volt primary circuits, or less, having a maximum temperature at full load not exceeding 65 degrees C. and designed to stand an insulation test without oil of 750 volts for five minutes, and a prolonged test of 10,000 volts with oil, will be in slight danger from lightning discharges if protected within a distance of 500 feet by a properly installed lightning arrester.

A transformer should also be able to stand a double primary potential test for five minutes, and the insulation test should be made between the coils and between each coil and the core.

In the case of transformers to be used exclusively on very high voltage circuits these considerations do not apply, nor should this paper be considered as dealing with this class of alternating apparatus, which has come to form a department by itself.

In considering the economy of transformers, the problem before us is not so much a discussion of their efficiency as a converter of electrical energy, as it is a discussion of this efficiency in connection with the numerous extraneous causes that tend to make the transformer a menace to life and property.

To my mind a great deal would be gained if an understanding could be brought about between the makers and purchasers of transformers that would result in a uniform practice in the several departments of transformer design. The manufacturers would work to better advantage by having definite specifications to work to, and the way would be open for a bonus or forfeit in equitable proportion to an excess of or shortage in the economy of the product. The fad at present tends toward over-protection. It is bad practice to run to extremes in any department of engineering, and too much protection may turn out to be just as costly as too little.

TWO-WIRE DISTRIBUTING SYSTEMS AND LAMPS, 200-240 VOLTS.*

BY JOHN W. HOWELL.

Distributing systems, operating at 200–240 volts with simple two-wire circuits, first attracted attention about four or five years ago. These early plants used two 110–120-volt lamps in series and were installed as a means of competing in cost of installation with three-wire plants without resorting to the alternating current system, with its disadvantages where motors are operated.

The growth of these plants was slow until the demand created by them led to the production of the 200–240-volt lamp, and practical experience had shown the weakness of these lamps and led the makers to overcome the difficulties met in their manufacture.

What these weaknesses were can be judged by the following extracts from previously published articles:

"The consensus of opinion at the present day of the average types of high-voltage lamps undoubtedly points to the fact that a large percentage are expected to short-circuit as soon as they are put up, and I have heard several engineers say that they expect about one in twelve to go in this way.

"There is no doubt whatever that almost all the present day 200-volt lamps are only suitable for burning in a vertical position. As soon as any other position is adopted defects become prominent. The long thin filament soon drops onto the bulb and cracks it. Also electrostatic attractions, owing to higher voltage, cannot be resisted by the long thin filament, and this is an additional cause of the filament approaching the bulb.

"The effect of electrostatic attractions on long thin filaments is even noticeable with lamps burning in a vertical position."

These are extracts from a paper read by Mr. G. Binswanger Byng before the British Institution of Electrical Engineers on February 24, 1898.

These defects have been entirely remedied, and the experience of many plants operating 200–240-volt lamps during the past year proves these lamps to be just as reliable in service as are 110-volt lamps. The development of the lamp has taken considerable time, and the growth of the 200–240-volt 2-wire system, in spite of the shortcoming of the early lamp, is due to compensating advantages in other elements of the system.

These advantages over the three wire system are—(1) cheapness of installation, and (2) simplicity of operation.

1. Cheapness of installation of the 200–240-volt 2-wire system, when compared with the 110–120-volt 3-wire system, arises from the use of a single large dynamo where the three-wire system requires two, each having half the capacity; with the accompanying duplication of regulating apparatus, indicators, ammeters, etc. There is also a saving of the entire cost of the neutral conductor of the 3-wire system, which conductor in street mains (as distinguished from feeders) and in house wiring should be as large as the outside wires.

Three-wire plants in cities, whose business warrants the employment of the skill necessary to operate the system to best advantage, successfully use 110–120-volt 3.1 watts per candle lamps and get very excellent results from them. The 200–240-volt 2-wire system cannot be considered a competitor of the 3-wire system under these conditions, since the best 200–240-volt lamp on the market to-day is a four watts per candle lamp. But it is my opinion that in smaller installations, whose conditions call for a 3.5 watts per candle lamp when a 110–120-volt 3-wire system is used, the advantages of the 2-wire 200–240 volt system are sufficient to offset the dis-

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advantages of a 4 as compared with a 3.4 watts per candle lamp. Under normal conditions the performance of the present four watts per candle 200–240-volt lamp as regards life and maintenance of candle power is about 25 per cent. poorer than the present 3.5 watts per candle 110–120-volt lamp, but it is my opinion that the greater irregularity in pressure ordinarily found in the 3-wire plants we are now considering, as compared with the 2-wire plants operated under similar conditions, fully counteracts by its injurious effects upon the lamps, the advantage in life and candle power which the 110–120-volt 3.5 watts per candle lamp has under normal conditions over the 200–240-volt four watts per candle lamp.

2. In considering the relative advantages of the two systems, in the case of moderate sized plants above referred to, we must charge against the saving effected in a 2-wire plant by its single equipment and omission of the neutral conductor, the increased capacity of machinery and conductors made necessary by a four watts per candle as compared with a 3.5 watts per candle lamp.

Considering the copper required by a 220-volt 2-wire system using four W. P. C. lamps as our unit, the copper required by the two outside conductors of a 110-volt 3-wire system using 3.5 W. P. C. lamps will be .875. The amount to be added to this for the neutral conductor will vary somewhat with location of the station with reference to the points of consumption. If we assume that one-half the copper is installed for feeders and one-half for the distributing mains, and that the neutral wire is one-third the size of the outside wire in feeders and the same size in mains, then the total copper in the neutral conductors of feeders and mains will be 29 per cent. of the amount used in the 2-wire 220-volt system, and the total copper used in the 110-volt 3-wire system will be 16 per cent. greater than the copper used in the 220-volt 2-wire system. This comparison of the cost of copper does not consider the cost of wiring customer's premises, which is usually borne by the customer; it is, however, an advantage to the 220-volt system that this wiring will require at least 20 per cent. more copper for the 3-wire 110-volt system than for the 220-volt 2-wire system.

The 4 W. P. C., as compared with the 3.5 W. P. C. lamp, would require for the 200–240-volt 2-wire system one-seventh greater capacity of boilers, engines and dynamos than would be required for the 3-wire 110–120-volt system.

The duplication of apparatus required for the 3-wire system will only partly offset this increased cost in the 2-wire 200–240-volt system, but the cost of this duplication of apparatus, together with the increased cost of copper required, will in many cases make the cost of installation of the 3-wire system at least equal to that of the 200–240-volt 2-wire system, leaving the simplicity of operation of the 2-wire system to be balanced against the increased cost of fuel required to operate 4 W. P. C. as compared with 3.5 W. P. C. lamps.

During the time the plant is operated considerably below its rated capacity, which will probably cover even the maximum load during the first year of the plant's existence, and all but three or four hours per day at all times, I think the increased fuel consumption due to 4 W. P. C. lamps will not be appreciable because of the poor efficiency of boilers and engines with light loads, and the total increased consumption of coal during the year will, I believe, be a small consideration under most circumstances, and in my opinion not enough to balance the simplicity of operation above noted.

A few months ago I made a trip through some of our central States, visiting a number of 200–240-volt plants to get a knowledge of the practical workings of the systems from the persons actually operating them, hoping to get from their experience, information concerning existing conditions which would be of value in the lamp factory.

Naturally, my first question to the man who operated the plant concerned the lamps; were they generally satisfactory? were they long lived? did they ever explode? I was greatly pleased with the answers I received. The lamps were reported to be almost universally satisfactory. They were very long lived—in fact too long lived, for better service would be rendered if the lamps were renewed when they began to get dull, and not allowed to remain in service after they ceased to give a first class light.

These 4 W. P. C. 200–240-volt lamps may be used for 600 hours and still give a good light, but I think this is about the limit of their useful life. If not taken in they will keep on burning for a long time and will give an average life of over double that figure before breaking.

The reports concerning exploding were equally satisfactory. For the past year or more exploding lamps had been practically unknown; previous to that time, however, this had been one of the most serious objections to the system.

All these plants have been installed with switches, cut-outs and other appliances made for 110–120-volt installations, and it is remarkable how little trouble has been caused by them.

SOCKETS.

Ordinary key sockets have been freely used, and experience has shown the Edison screw socket and lamp base to be preferable to other types. Some engineers recommend keyless sockets and good snap switches to avoid possible failure of the key socket to break the circuit.

In order to get the desired factor of safety a company has recently developed a special key socket for this work, having a break gap twice as great as the sockets designed for 110–120-volt systems, and having a fiber insulating lining between the outside shell of the socket and the screw shell which is connected with the circuit. This fiber lining projects sufficiently beyond the screw shell to prevent contact with the circuit when the lamp is in the socket. The lamps are provided with short bases designed to be completely covered with this fiber lining, so it is impossible to get a shock by touching the lamp when it is burning.

FLEXIBLE CORD.

Flexible cord has been freely used and is all right if the best quality is used. For this purpose the conductors should be covered with rubber one-thirty-second inch thick and the outside covering should be silk, or if cotton it should be slicked with a compound which makes it non-inflammable.

ROSETTES.

Rosettes designed for 110–120 volt circuits having fuses have given a good deal of trouble, so it has become good practice to leave out the fuse wire and put copper wire in its place, thus having no fuse between the lamp and the fuse block close to the switch controlling the circuit.

CUT-OUTS.

Fusible cut-outs designed for 110–120 volts have failed in many instances, and have often proved much more fusible than their makers expected them to be.

A complete line of fuse blocks carrying special 200–249-volt fuses has been developed recently. These are fitted with the cartridge type of fuse, the fuse being contained in a tube which is provided with brass terminals which fit in spring clips on the fuse block. The fuse wire is inside the tube and is soldered to the brass terminals. The tube is then filled with a plaster compound which smothers the arc formed when the fuse blows. These fuses have been severely tested with 500 volts and currents many times their rated capacities and have always opened the circuits without a flash.

SWITCHES.

Standard knife switches or quick-acting snap-switches having large break distances should be used. Such switches specially designed for 200–240 volt installations are now being developed.

WIRING.

Standard methods of wiring for 110–120-volts are approved for 220–240-volts. Good rubber-covered wire run on porcelain knobs or cleats is specified by the fire underwriters.

ARC LAMPS.

Good arc lamps burning two in series on 220-volt circuits are on the market. Each lamp is provided with an automatic cut out which throws an equivalent resistance into the circuit when one lamp is extinguished, thus permitting the use of one lamp if desired.

FUTURE.

The future of the 200–240-volt system depends largely upon the development of a more economical lamp. All other elements of the system can be made entirely satisfactory with the means and knowledge now at our command, but the production of a more economical lamp calls for an advance in the art of lamp manufacture. That this advance will be made and a more economical lamp will be produced I have no doubt, and hope to see such a lamp placed upon the market at an early date.

A NEW OUTLET FOR ALUMINUM.*

The supply of a material and its consumption sometimes fall out of step with each other. A given manufacture may be so greatly improved as to turn out a product in abundance a little embarrassing to a not too absorbent market. It has been said that some such trouble has made itself felt in the aluminum history. Whether this is true or not, it is certain that one of the largest and most flourishing of our electrolytic manufactures will welcome a new outlet which will aid it in expanding freely and naturally without fear of superabundance of supply. Dr. Goldschmidt, of Essen, at the recent annual meeting of the German Electrochemical Society, held at Leipzig, went far to show that such a use as we have indicated has arisen and may be extended. The experiments of numerous observers have demonstrated that aluminum, on account of its high heat of combination, can be used to reduce the most refractory oxides, and that the rise of temperature accompanying the reaction is commonly so great that the reduced metal is fused into a reguline mass at the moment of its reduction. In this country Mr. Vautin was, we believe, the first to apply this principle to the preparation of refractory metals, such as chromium and tungsten. The system has been improved and made a commercial success at Krupp's works at Essen, and Dr. Goldschmidt, who we understand has worked in conjunction with Mr. Vautin, is largely responsible for this development.

In the earlier experiments the substance to be reduced, say chromic oxide, was mixed with aluminum in powder and the mixture heated in a crucible. This procedure presents certain defects. The heat being applied from without and to the whole mass, frequently induced a reaction so violent as to be explosive, and as a consequence the air was thick with comminuted crucible. A remedy for this was found by igniting the mixture of aluminum and the refractory oxide to be reduced, by means of a fuse composed of material such as powdered aluminum and an easily reducible oxide or peroxide which could be fired at a much lower temperature than that necessary for starting the reaction between the main constituents of the mixture. By this means the temperature of *one part* of the charge is brought to its reaction point while the rest remains cold, and the reaction thus induced is gradual and not explosive, and is altogether more controllable.

There are two uses to which this method can be put. On one we have touched, viz., the preparation of difficultly-reducible metals; it is to this that we owe the considerable masses of chromium and its

* From the *Electrical Review*, London.

alloys which are now obtainable at a relatively cheap rate. The other is a highly ingenious application of the same principle to a totally different object, viz., the uniform and powerful heating of particular parts of metallic objects—in a word, for fusing, autogenous soldering, brazing or annealing. It suffices to surround the portion to be heated with a mixture of powdered aluminum and a cheap difficultly-reducible oxide, *e.g.*, ferric oxide or silica, and to kindle the mass by a fuse of aluminum and an easily-reducible oxide; the parts embedded in the mixture are thus raised to a temperature which can be adjusted with precision by using a charge of appropriate size. The method may prove a formidable rival of other methods of jointing by means of heat, such as hard soldering and electric welding. As compared with the latter, the heat, although kept well to the parts to be joined, is nevertheless less severely localized, and this is sometimes a sensible advantage.

It is evident that this method of obtaining high temperatures may be regarded as equivalent to the use of a "secondary" or "poleless" electric furnace. These terms are not merely fanciful; they recall the fact that the energy which can be usefully expended for the purposes spoken of above has originally been obtained from the water power employed to produce current for the reduction of the aluminum electrolytically. In the electrolytic aluminum furnace, which may be regarded as a step-up transformer for chemical energy, the very energetic substance, aluminum, has been prepared, constituting a portable source of high temperature heat.

A point of practical importance is that it seems unnecessary to prepare pure aluminum for use as a heating and reducing agent. A crude aluminum, perhaps obtained directly by the electrolysis of bauxite in place of the nearly pure alumina laboriously prepared from bauxite which is customarily needed, may be specially manufactured for such uses. A high content of iron and silicon will be of no detriment to the use of the metal, for both will burn giving much heat. Similarly, when the manufacture of a given refractory metal, say chromium, is undertaken, it is clear that the aluminum oxide produced by the action of the aluminum on the chromic oxide can be reduced again in the electrolytic furnace, any chromium which it may contain being thus returned to the cycle of operations. The question naturally arises whether chromium could not be reduced electrolytically (not simply by electric heating in the manner of Moissan) in a similar way to that employed for aluminum. However this may be, it is certain that all but the largest users at present would prefer to buy their aluminum for the reduction of chromium rather than to set up a comparatively costly plant.

COWPER-COLES'S REGENERATIVE ELECTRO-ZINCING PROCESS.

The first care in electro-zincing is to have a properly prepared surface; all traces of grease and rust must be removed. The grease is usually removed by immersion in a caustic soda solution, about ½ lb. to the gallon of water, or, on the other hand, the grease and the scale are removed by sand-blasting. The more usual practice for removing the scale and oxide, but not the best, is to place the iron work to be zinced in a hot pickle solution containing about 1 per cent. of commercial sulphuric acid. The chief difficulty hitherto experienced in the electro-deposition of zinc has been to keep the electrolyte in working order, as zinc anodes, whether cast, rolled or amalgamated, or in the form of granulated zinc, fail to keep the solution up to its normal strength. This difficulty has been overcome in the Cowper-Coles regenerative process by the use of zinc dust which usually contains 97 per cent. of metallic zinc. The zinc dust or tultz is a grayish amorphous substance, and must not be confused with zinc oxide. It is obtained as a sublimal product in the flues of the zinc smelting furnaces. The zinc dust is placed in regenerating tanks mixed with fine coke or sand upon perforated grids fixed about half way down the tank, so as to form a filter bed. Any free acid present in the electrolyte in passing through the filter bed is neutralized. If the zinc dust is allowed to get into the electrolyte it is found to increase the electrical resistance. A zinc sulphate solution containing 12.59 acid, after passing through a filter bed containing 10 per cent. zinc dust, was found to contain only .68 per cent. of free sulphuric acid. In this way the solution can readily be kept up to its normal state, and quite free from impurities in suspension, which has been found to be one of the chief causes which lead to the formation of zinc sponge. The regenerating tanks are connected to the depositing vat by a system of piping, the electrolyte flowing into the bottom of the depositing tank by gravity, the lighter liquid being drawn off over a sill at the end or in the corner of the vat. One tank discharges the regenerated solution while the other is constantly being filled by a small rotary pump. The electrolyte is composed of 40 ounces of zinc sulphate to the gallon of water, and has a specific gravity of 1.1770 (=19 per cent. of crystallized zinc sulphate). The anodes are made of lead, and the current density is 17 amperes per square foot, the EMF. at the terminals of the generator being 6 volts. A bye-pass is provided so that the solution can be circulated without having to pass through the regenerating tanks.—*Electrical Review, London.*

THE TELEPHONE IN ITALY.

The telephone concession of Florence, says the London *Electrician*, includes the town and the adjoining suburban communes, with a population of about 250,000 inhabitants. The telephone was introduced into Florence by two companies—one Italian and one English—both holding concessions for Bologna as well as Florence, the Italian concession including Leghorn. In 1883 the two companies amalgamated and formed the Societa Telefonica per l'Italia Centrale, with a capital of $300,000. The early concessions granted by the Government had only the duration of three years, after which the Government was at liberty either to renew the concessions, grant new ones, or to establish Governmental telephonic communication. To this latter effect the Government presented a bill to Parliament by which all the existing concessions at their expiration were cancelled without any right of compensation or any obligation on the part of the Government to buy the lines and offices already established. This bill, approved by the lower House, was rejected by the Senate. A new bill was then presented and approved by Parliament by which the right of granting concessions for private or public telephonic communication was entirely reserved to the Government. The law fixed the duration of each concession to 25 years, after which all the plant, line and premises become the property of the State. The Government has also the right after 12 years from the date of each concession to take possession of the concern by paying a sum equal to the average net profit of the three preceding years multiplied by the number of years which each concession has still to run to reach the final period of 25 years determined by law.

The same law establishes a tax of 10 per cent. on the gross profits of each concession for public use, the right of free communication for all the postal and telegraphic offices, and a reduction of 50 per cent. on the public tariff in favor of all Government, provincial and municipal offices. As a compensation, however, the companies have the right to fix wire supports on all public and private properties. When a private proprietor refuses to grant the permission a simple application to the Prefect is required to obtain the enforcement of the law. The proprietor may ask for an indemnity, and if both parties do not agree the Prefect decides if any and what amount for once only is to be paid. As soon as the Italian telephone companies saw their existence insured for a fixed period they began to reorganize their services by changing the apparatus, wires, etc., with the object of diminishing working expenses so as to enable them, besides distributing a dividend to the shareholders, to yearly set apart a sum for the reimbursement of the capital at the expiration of the concession. Experience proved that these objects could not be attained by small companies on account of the heavy expenses of management and the necessity of having a uniform technical direction, and they therefore amalgamated and formed larger companies. This amalgamation is now under execution.

Florence is now a branch exchange of the Societa Generale Italiana dei Telefoni ed Applicazioni Elettriche, with a capital of $1,200,000, and owns the telephonic exchanges of Rome, Naples, Genoa, Palermo, Venice, Leghorn and most other important towns, with the exception of Milan and Turin, where the old local companies have formed the Societa Telefonica per l'Alta Italia. The number of subscribers in Florence is only 900, and the following is the tariff of rates charged:—$32 within 1,093.61 yards from the central office, $36 within double that distance, $40 within three times above distance, and for further distances $1.40 for every 218.722 yards. The apparatus and instruments were wholly supplied by the Antwerp Telephone and Electrical Works. The wire used is silicon bronze for the lines in the interior of the town, and steel or iron for the country. All subscribers have the right to complete service day, night and Sundays.

The operators are females, hours from seven to eight per day, salary from $6.25 to $12.50 per month. A fortnight's leave of absence is granted yearly, and a holiday on each alternate Sunday. Workmen employed in the maintenance of apparatus receive from 40 cents to 62 cents per day; linesmen from 40 cents to 50 cents, with a holiday on every alternate Sunday and a half holiday on Saturdays. All workmen are insured against injury or death, this insurance being obligatory by law. In case of injury full wages is paid during illness, in case of permanent disablement 900 days' wages, and the same compensation is due to the families in case of accidental death. In ordinary sickness workmen are supported by the company for a certain period according to length of service, but in no case under three months. Hours of work ten, with 4 cents for every extra hour. During the summer months a few days' holiday is granted. Each workman has from 150 to 200 instruments to look after.

The original local company distributed a dividend varying from 2 to 3 per cent. The new amalgamation has not yet published a balance-sheet, but it is expected that the dividend, if any, will not be in excess of the above rate. With a 10 per cent. concession tax and 20 per cent. income-tax, and the necessity of refunding the capital, very little extra profit is likely to be available for distribution.

Mica Mining in India.

Mr. Robert W. Thompson, A. M. I. C. E., sent a most interesting article to the *Journal* of the Society of Arts on mica mining in the district of Nellore, India. The author states that mica exists in the western parts of the district, where the land begins to rise to the ghâts. The surface indication of it is the outcrop of quartz and felspar, with which minerals it is usually associated, being sometimes integrated with them so as to form a coarse-grained granite, or else occurring in large separate masses. It is not unusual to find distinct masses of mica, of quartz and of felspar, lying contiguous to each other; the idea which they convey being that nature in-

tended manufacturing granite on the spot, but after collecting the necessary materials had changed her mind about it. But the surface indication above mentioned is not always present: in some cases mica occurs in isolated blocks.

There are mica mines in operation at Inikurti, Utukur, Chaganum, Sydapuram, Khandali, all lying from W.S.W. to S.S.W. of the town of Nellore, at from 20 to 30 miles distance. Indications of mica are met with further north, but no mines have yet been started; the industry is, in fact, in its infancy, the first mine, the one at Utukur, having only been started in 1888. The mineral is found near the surface, and those hitherto engaged upon the getting of it not being professional miners, but mere diggers, the only method of working yet adopted has been that of quarrying—no subterraneous mining has yet been attempted. The mica occurs in masses of from 100 to 200 cubic feet; these masses have been found from near the surface to a depth of 70 feet, the method employed for detaching the stuff being blasting with gunpowder or dynamite.—*Elec. Engineer, London.*

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LONDON NOTES.

[From our London Correspondent.]

Electric Tramways at Halifax, Eng.

A four-mile length of electric tramway (overhead wires) has been opened by the Halifax Corporation, current being taken from the municipal lighting station. From its size the line is of no special importance, but for one section, 1½ miles long, there is a continuous climb, averaging 1 in 20, and this will be a good opportunity for electric traction to prove to English eyes of what it is capable. On the ascent it is stated that to propel a car up one of the gradients requires an expenditure of nearly 100 amperes, but on the "down" journey no current whatever is consumed, and in addition to the ordinary brake a special slipper brake has to be employed, while there is also an electric emergency brake. The track is 3 ft. 6 in. gauge throughout, with 98 lbs. girder rails. There was added to the plant at the lighting station for the purpose of the tramways an E. C. C. generator, rope driven, and of the four-pole type. This generator has an output of 220 amperes at 500 volts. There is also to be a motor alternator, a battery of 270 chloride cells and a motor driven booster. As the plant was added at the lighting station the outlay for the necessary new machinery, etc., and alterations to buildings only came to about $40,000. There will shortly be several other local authorities equipping tramlines on the same principle, and this Halifax plant will be watched with interest. It is important to note in this connection that the Dover municipal trams, which have been in operation for not twelve months, have already made sufficient profit on the lines to enable a reduction to be made in the rates. This is a fact which will tell with the municipalities. The Corporation, it may be remembered, has no generating station or plant of its own, but takes its supply of current from the lighting company at so much per unit under agreement. In this way the Corporation is free from heavy interest on capital charges which will be a burden to municipal bodies which have no lighting plant of their own.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

DEATH OF CORNELIUS HERZ.

Cornelius Herz, whose death at Bournemouth, Eng., on the 6th inst., is announced, had some reputation as an electrician, but his work in that direction was principally as promoter of electrical enterprises. His place of nativity is not certain, Besancon, France, and Worms, Germany, both being named in that connection. It is known, however, that his father was a German Jew and his mother a Frenchwoman. When he was quite young his family removed to England, but after a short stay there came to this country and took up their abode in New York. In 1864 young Herz was graduated from the College of the City of New York, and was subsequently sent to Heidelberg, Munich, Vienna and Paris to continue his studies. During the Franco-Prussian war he was appointed assistant surgeon-general in the Army of the Loire, and for his services was decorated with the cross of the Legion of Honor. When the war was over he returned to New York, where he married Miss Bianca Saroni, said to be a niece of the poet Heine. Soon afterward the young couple moved to San Francisco and there Herz started on his career as an electrician and succeeded in establishing an electric lighting system which remains to this day and has expanded into one of the most important business concerns in the city. In 1877 he went with his family to Paris and started on a brilliant career. He overthrew the gas monopoly, and provided the main thoroughfares with electric light. He founded *La Lumière Electrique*, one of the leading electrical journals of France. He established the telephone system of France, organized the first electric exhibition that was ever held, and finally became associated with the Rothschilds in putting into practice the theory of the transmission of force by electricity. At the same time he rapidly became a great social and political figure in the Republic. He was the bosom friend of the prominent men of the day, and rumor credited him with being the power behind the President's chair.

When in 1893 Charles de Lesseps made a clean breast of his transactions in connection with the Panama Canal, Herz was accused of receiving 600,000 francs paid over by De Lesseps in 1886. The cries of "foreign Jew" and "British spy" were raised against Herz in the French Parliament and by the newspapers of Paris. The trial of Herz began on July 27, 1894. He was then at Bournemouth, England. He had been ill, and was not expected to live. The case went against him, and two houses in Paris, the property of his wife, were ordered to be sold. Exhaustive formalities looking to extradition of the fugitive were vainly continued for several years, and Scotland Yard detectives were constantly at Bournemouth.

Herz's downfall was complete. In this country even his right to the title of "doctor" was questioned, and various colleges disclaimed ever having given him a professional degree. In England his sympathizers said that a brilliant man had been hounded to death by the French Government merely because of the unusual circumstance that he, though a foreigner and a Jew, had been high in the Legion of Honor. His grasp of scientific subjects and ability for business transactions were lauded by some and scoffed at by others.

Some months ago he had a claim filed in the Department of State at Washington for $5,000,000 against the French Government, alleging that he was despoiled of his property in France on no other ground than persecution. The matter is still under advisement.

KING LEOPOLD of Belgium has commissioned Mr. R. D. Mohun, United States Consul at Zanzibar, to build a telegraph line from Lake Tanganyika to Wadelai on the Upper Nile. Mr. Mohun will in the work employ none but American and British engineers.

SOCIETY NEWS.

American Institute of Electrical Engineers.

At the meeting of the Executive Committee, June 24, Mr. C. O. Mailloux, of New York, was elected a Vice-President of the Institute to fill the vacancy caused by the previous election of Dr. A. E. Kennelly to the Presidency. Mr. Robert N. Baylis was also appointed a member of the Board of Examiners, succeeding the late Dr. Chas. E. Emery.

The following associate members were elected:

Walter Cummings Allen, Washington, D. C.
Albert H. Armstrong, Schenectady, N. Y.
Geo. A. Damon, Chicago, Ill.
Frank H. Dexter, Ithaca, N. Y.
P. M. Downing, Blue Lakes City, Cal.
Joseph Lyons, Washington, D. C.

The following associate members were admitted to full membership:

Alfred A. Thresher, Dayton, O.
William B. Jackson, West New Brighton, N. Y.
Paul M. Lincoln, Niagara Falls, N. Y.
Thorburn Reid, New York City.
Philip Green Gossler, Montreal, Can.
Theodore E. Theberath, San Francisco, Cal.
Frederick M. Pedersen, New York City.
Will K. Dunlap, Niagara Falls, N. Y.

American Society of Civil Engineers.

The American Society of Civil Engineers will hold its Thirteenth Annual Convention in Detroit July 26 to 29, inclusive. The headquarters of the Convention is to be the Fellowcraft Club, and all meetings will be held there. The programme calls for the opening session of the Convention at 10 o'clock Tuesday morning, July 26. Alphouse Fteley, president of the society, will then deliver the annual address. The next session is put down on the programme to begin at 14:30 o'clock. Then will begin the discussion of the papers. At 16:30 there is to be a trolley ride about the city, tendered by the Detroit Electric Railway; and at 20 o'clock there will be an excursion upon the river by courtesy of the Detroit, Windsor & Belle Isle Ferry Company.

Two sessions will be held Wednesday, beginning at 10 and 14:30 o'clock respectively, the balance of the day being devoted to side trips to points of engineering interest about Detroit. On Thursday the society will go in a body to inspect the Port Huron tunnel. The Grand Trunk Railway has tendered a complimentary train to the society for the trip to Port Huron, the return to be made by steamer. On Friday the Convention will resume business in Detroit, and Friday evening the Convention will terminate with a reception.

The papers to be read at the Convention are:

"Experiments on the Flow of Water in the Six-foot Steel and Wood Pipe Line of the Pioneer Electric Power Company at Ogden, Utah," by Charles D. Marx, Charles B. Wing and Leander M. Hoskins.

"The Determination of the Safe Working Stress for Railway Bridges of Wrought Iron and Steel," by E. Herbert Stone.

"Marine Wood Borers," by Charles H. Snow.

"Dredges and Dredging on the Mississippi River," by J. A. Ockerson.

"Reservoir System of the Great Lakes of the St. Lawrence Basin; its relation to the problem of improving the navigation of these bodies of water and their connecting channels," by Capt. Hiram M. Chittenden, U. S. A., with a mathematical analysis of the influence of reservoirs upon stream flow, by James A. Sedden.

"Three-hinged Masonry Arches: long spans especially considered," by David A. Molitor.

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LEGAL NOTES.

In Judge Clifford's court at Chicago on the 6th inst. the Hyde Park Electric Light & Power Company confessed judgment on two notes aggregating $20,891, one for $14,891,52 being held by Clarence N. Goodwin. The other was for $6,000, and was held by Robert F. Hall.

The Cornman Company, dealers in electrical supplies, Cleveland, O., have filed a deed of assignment in the insolvency court. Their assets and liabilities are fixed at $10,000 each. A. R. Manning, jr., was appointed assignee.

The Probate Court Judge at Canton, O., has appointed C. C. Davidson receiver of the Alliance Street Railway Company of Alliance, O. The appointment was made on the petition of Henry C. Ellison of Cleveland.

A final decision in the transfer suit at Atlanta, Ga., has been made by Judge W. T. Newman in the U. S. District Court. It forever enjoins the city of Atlanta from enforcing the street car transfer ordinance.

The owners of the Read House, Chattanooga, Tenn., have a large number of storerooms on the ground floor of the building which they let out to various tenants, to whom they agree to supply water and electric lights. Recently suit was brought by the city to compel the owners of the building to pay a license for operating an electric light plant. Judge Estill of the Circuit Court, before whom the case was argued, decided that the Read House people were not manufacturers of light in the contemplation of law, not being in the business to furnish light to general consumers, but only to tenants of their own property.

Judge Lacombe, in the Circuit Court, New York, has granted the application of the Thomson-Houston Electric Company for an appeal to the Circuit Court of Appeals from a decision by Judge Shipman in the Circuit Court, dismissing the company's bill of complaint against the Union Railway Company and the Walker Company. The complainants charged the defendants with infringing a patent for improvements in overhead contact electrical devices or switches. The suit of the Thomson-Houston Electric Company vs. Ed. A. Maher and the Walker Company for a preliminary injunction restraining the defendants from alleged infringement of certain claims in letters patent No. 495,443. granted to Chas. J. Van Depoele, was dismissed.

The State Supreme Court at Indianapolis has overruled a petition for a rehearing in the case of the city of Indianapolis against John N. Navin who was arrested for refusing to pay a 5-cent fare to the conductor of a car of the Citizens' Street Railway Company. The suit was brought to test the constitutionality of the 3-cent fare law, Judge Showalter of the Federal Court having granted an injunction against the enforcement of the law. The Supreme Court takes issue with Judge Showalter in the following somewhat egotistical passage from its decision: "We (the Indiana Supreme Judges) are constrained to adhere to our original opinion that the act in question, even if local and special, is not in contravention of any of the provisions of the constitution of this State as contended by the appellant. As to questions arising under the constitution of the United States, we should be constrained to follow the adjudications of the Supreme Court of the United States without in any wise considering whether such a construction should or should not commend itself to our independent judgment, but upon the requirements of the constitution of the State we are not at liberty to set aside or discard our own views, because of the fact that they do not meet with the concurrence or approbation of any other court however high, or any judge however eminent."

Judge Kilpatrick, at Trenton, N. J., has issued a temporary injunction in the case of the Sprague Electric Railway & Motor Company against the Camden & Suburban Railway Company. The latter has five trolley cars purchased of the Walker Company which are equipped with motors which the courts have pronounced an infringement of the Sprague patent.

At Milwaukee, Wis., on July 6, Judge Seaman, in the United States Circuit Court, handed down his decision in the suit of the Western Electric Company against the American Rheostat Company and others of Milwaukee, in favor of the petitioner. The effect is to prevent the defendant company from further manufacturing of electric cutouts or rheostats, the Court deciding that the defendant has been infringing upon the patent of the complainant.

In the matter of the application of the Baldwinsville (N. Y.) Telephone Company for a peremptory writ of mandamus, Justice Hiscock has denied the application with costs. The application was to compel the Central New York Telephone & Telegraph Company to place in the office of the petitioner "one of its telephone instruments with the usual and proper wires and connections and to allow said Baldwinsville company the proper and usual and customary use of said telephone wires and connections." The petitioner's claim was that a request was made of the defendant to place a telephone in its office at the regular price; no telephone was thus placed and his application for telephone service was duly filed. The petitioner based his claim for relief upon the general obligations which the company by entering upon a general telephone business incurred. The judge holds that a reasonable construction of the statute does not require one telephone company to supply connections with its system to another company, so that the latter may utilize the connected system as part of its own and transmit thereover its own messages on payment of the merely nominal sum required of ordinary subscribers.

Personal.

The *Electrical Engineer* has recently added to its editorial staff Mr. Max Lowenthal, who will hereafter hold the position of associate editor on that well-known weekly. Mr. Lowenthal would seem eminently fitted for the duties he will be called upon to perform, having studied extensively abroad, and having graduated at the head of his class in electrical engineering from the Hebrew Technical Institute, and also holding the degree of E. E. from Columbia University. Mr. Lowenthal was for some time in the testing rooms of the Western Electric Company, and later had charge of the testing department of the Schuyler Electric Company at Middletown, Conn. He has been a frequent contributor to a large number of electrical journals, is a member of the New York Electrical Society and an associate member of the American Institute of Electrical Engineers. We wish him success in his chosen field of labor.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING PLANTS.

Algona, Ia.—An electric light plant is being erected here at a cost of about $15,000. The contract for the machinery has been given to Mr. Bigelow of Lincoln, Neb. The plant is to be first class.

Bunker Hill, Ill.—An electric light plant will be established here for which about $7,000 worth of bonds will be issued.

Duluth, Minn.—The lighting problem is bothering the city fathers. The city now pays $50,000 yearly for its lights and it is proposed if the cost is not materially reduced by the electric lighting company to substitute some other system of illumination. The lighting company's contract expired a few weeks ago, but the service will be continued at the contract price until some decision is reached by the council.

Flatonia, Tex.—The electric plant, now under construction, will be ready to operate in a few weeks. About 450 lights have been subscribed for.

Flint, Mich.—Receiver Clarence Tinker has been ordered by the court to sell the Fenton electric light plant to Fayette Thompson, whose bid was $9,000.

Hagerstown, Md.—The street commissioners have rejected the proposition of the Hagerstown Electric Railway Company to light the town for $77.77 a light annually on a ten year contract. Public sentiment is in favor of the building of a municipal plant.

Holyoke, Mass.—The board of public works has requested the city solicitor to give his opinion as to the rights of the city in securing electric light service when the present contract expires.

Jamaica, L. I.—The electric light company cut off its lighting service on Friday night because Controller Coler refused to pay the bills of the company, amounting to $22,000.

Lebanon, Pa.—Proposals will be received until August 2 by the police committee of this city to furnish the city with electric street lighting, beginning June 1, 1899, to consist of not less than 125 arc lights of 2,000 candle power each, burning every night from twilight to dawn. Proposals to be contingent upon a contract for five years, also for ten years, and price per lamp per year to be made accordingly.

McArthur, O.—The town council has voted to issue $5,000 worth of bonds to install an electric lighting system.

Nashville, Tenn.—Postmaster Wills has secured an allowance of $3,000 from the Department at Washington to be expended upon new electric lights for the city post office.

Providence, R. I.—The contract between the city and the Narragansett Electric Lighting Company has been ratified by the council. The contract runs to the year 1912. The terms of the new contract, in a general way, are that the Narragansett Electric Lighting Co. agrees to bury its high tension wires and in addition to provide a sliding scale of prices which, covering the period to the time named above, gives a distinct and steady reduction in the price of the city lights. The company also agrees to pay 5 per cent. of its gross receipts to the city. The only opposition to the adoption of the new contract was suggested by the advocates of a municipal plant, and this dwindled away in view of the general belief that rates offered were far lower than those secured in the municipal plant experiment.

Topeka, Kan.—The Executive Council has decided to light the State House by an independent plant and has made a contract with the Fort Wayne Electric Corporation for the machinery.

Westbrook, Me.—The city council has directed the committee on lights and water to advertise for bids for the construction of a municipal electric lighting plant to cost about $4,000.

West Superior, Wis.—The proposition of the Water, Light & Power Company for a five years' lighting contract here has been accepted by the council, ending a negotiation which was opened over a year ago, when the city complained that it was costing too much for lights. The city takes 150 arc lights at $100 each per annum.

STREET RAILWAYS.

Akron, O.—A new company has been organized to build an electric railroad from this city to Cleveland. A gang of surveyors are now at work laying out a route.

Brooklyn, N. Y.—The Nassau Electric Company has made a test of a new combination car which is the idea of President Albert Johnson of the company and which appears to meet the requirements of the road better than any other style in use. The car is entirely closed upon one side, preventing either egress or ingress upon that side. The other side is open, and is equipped with sliding doors, which can be closed or opened to suit the weather conditions. The sliding doors, when opened, make the car practically an open car and when closed make it a closed car. The large windows in front and at the rear of the car likewise open and let a free sweep of air through. The only ingress and egress is at the right side where there are sliding doors, and the seats are placed back to back. President Johnson proposes to build 180 of these cars this summer, and to transform as many of the old-fashioned open cars into the new style. The car is said to have the advantage over the ordinary closed car that it will seat fifty passengers, while the old will seat but twenty-six people. —The Brooklyn Heights Railroad Company has begun work on the Sea View Elevated Railroad property, which runs between Coney Island proper and Brighton Beach. The improvements include the building of several hundred feet of bulkhead and the filling in of property which will reclaim several thousand square feet of ground. Two terminals are to be built—one at the entrance of the Brighton Beach Hotel and the other at the Brighton Beach racetrack. It is expected that the work will be finished within two weeks, and the cost is estimated at $20,000. The old engines and cars that have been used for the past years will be abolished and electric motor cars will be substituted.

Charleston, S. C.—The Charleston City Electric Railway Company has just reached its first anniversary and the enterprise has proved a success. The road has paid its way from the start, and has not only earned its fixed charges, but is able to pay a dividend of 5 per cent. on its stock and leave something to place to surplus.

Chelsea, Vt.—An electric railway is proposed to connect Chelsea and South Royalton and to be equipped for passengers and freight.

Delaware, O.—The Delaware Electric Street Railway has been appraised by order of the Common Pleas Court at $15,900. The road cost $75,000 and has been offered at public sale four times by the receiver and returned for want of bidders.

Detroit, Mich.—Leading business men have signed a petition to the common council for an ordinance permitting the street railways to carry light freight.

Grand Rapids, Mich.—The Grand Rapids & Lake Michigan Electric Railroad Company intends to apply to the common council for a franchise to occupy certain streets in this city as a part of the direct line to Holland and Macatawa park which will be constructed this season. The company has the right of way already acquired from Macatawa park to the city line, and the franchise asked for will give it an entrance into the city.

Greensburg, Pa.—The Greensburg, Jeannette & Pittsburg Electric Street Railway, between Greensburg and Manor, has changed hands. A syndicate composed of Harrisburg capitalists has purchased it. Benjamin Myers and Patrick Russ of Harrisburg are the principal members of the new company. C. L. Brinser of Harrisburg was elected superintendent of the company and has taken charge of the line. It is the intention of the new company to improve the road and rolling stock and extend the line to Irwin this summer. The company also proposes purchasing the Greensburg and Hempfield Electric Street Railway, between Greensburg and Huff, changing it to standard gauge and extending it to Mt. Pleasant.

Lowell, Mass.—The Clinton selectmen have decided to grant to the Clinton, Hudson, Maynard & Concord Street Railway Company a franchise to build and operate an electric railway from the "Acre" in Clinton to the Berlin town line. This practically puts an end to the hottest struggle for a franchise between rival companies that any town in Massachusetts has had.

St. Louis.—The State Supreme Court handed down a decision sustaining the action of the State Board of Equalization to compel the street railway companies of St. Louis to make their official returns to it instead of to the city, as they have been doing. The court held that it was unconstitutional to render such returns to the city.

Petersburg, Va.—The Piedmont Traction Company has petitioned the council for right of way through the streets of this city for a new electric railway.

Peekskill, N. Y.—The highway commissioners of the town of Cortland have granted a franchise to the Peekskill Traction Company to build and operate a trolley railroad on certain highways.

Providence, R. I.—The New York, New Haven & Hartford Railroad Company, it is stated, intends to operate the road between this city and Warren and Bristol by electricity.

Minneapolis, Minn.—The board of trade at a recent meeting adopted a resolution congratulating the Twin City Rapid Transit Company upon the excellent service inaugurated in the new Interurban line.

Trenton, N. J.—At a recent meeting of the stockholders of the four street railway companies concerned it was voted to consolidate the Trenton Passenger Railway Company, the Ewing Passenger Railway Company, the Mulberry Street Railway Company, and the Pennington Avenue Passenger Railway Company. The new company will be named the Trenton Street Railway Company.

TRANSMISSION PLANTS.

Little Rock, Ark.—There is talk of "harnessing" the Ouachita River at or near Malvern for the production of electric power. It is estimated that 5,000 horse power can be made available at Malvern.

Oakland, Cal.—The Oakland "Examiner" says: "The company which is developing a water supply and electrical power in Sutter Creek, Amador county, of which W. Frank Pierce is president and manager and T. C. Bullock superintendent, is preparing to transmit energy to the bay cities. The authorized agent of the company, Attorney George De Golia, has petitioned the board of supervisors for permission and franchise to erect telegraph poles through Alameda county to the plant for the conveyance of electrical currents. The following roads are named in the petition: Oakland & Haywards County road, San Ramon road, Crow & Norris Canyon roads, Redwood Canyon road, Cull Canyon road, Castro Valley road and Lake Chabot road. The matter was referred to the franchise committee."

MANUFACTURING, ETC.

Cleveland, O.—The Walker Manufacturing Company has secured the contract for erecting the extensive electrical plant of the Union Carbide Company of Chicago, to be erected at the falls of the Sault Ste. Marie.

New York.—The Journal of Commerce says: "The opportunities for the sale of electrical railway equipments in Japan are becoming evident. The Tokio Electric Railway Company and the Tokio Electric Car Railway Company have been organized, and, according to the latest report, they will re-equip the existing horse car lines in Tokio and build new electrical railways. The first-named company has at present a capital of $2,500,000, and will control all the lines in the eastern half of the city, aggregating 100 miles of track, to be built within five years. Twenty miles of horse car line is to be changed to electricity. The second-named company will operate the lines in the western portion of the city. Additional roads, aggregating about 200 miles, will be taken up by each company upon the completion of the first 120 miles by each. An estimate on the first 50 miles of road, including the entire equipment of cars and the power station, is placed at more than $2,000,000. A central power station will be built on the river about five miles from the center of the city, and power will be delivered to the trolley lines by eight transformer stations, placed at convenient points in the city. The roads are to be double-track. There is also in contemplation, according to the advices, a suburban line between Tokio and Yokohama 18 miles in length. In nine other cities and towns the arrangements are said to be under way for the construction of 135 miles of road in all."—The General Electric Company, it is announced, will within a few days ship the first of the electric motors to be used on the London Underground Railroad.

St. Louis.—President Julius S. Walsh of the Terminal Railroad Company is reported to have said that after a thorough search he has failed to find any practical plan by which the steam engine now used in the tunnel and railroad yards can be satisfactorily replaced by electric motors. The large number of trains hauled daily by the company in the St. Louis and East St. Louis yards and through the tunnel, could not, so Mr. Walsh avers, be properly cared for with the electrical engines now obtainable.

COMPANY MATTERS

Duluth, Minn.—On the application of Thos. Lowry, of Minneapolis, one of the stockholders, L. Mendenhall, the president, has been appointed receiver of the Duluth Street Railway Company. It is explained that this is the beginning of reorganization, made necessary by an excessive capitalization and shrinkage in Western business and values since the panic of 1893. It is not caused by any pressing exigencies or dissension. The present management will continue.

Jamaica, L. I.—The Queen's Borough Electric Light & Power Company, recently incorporated, has absorbed the Cittzens' Company of Far Rockaway. In order to meet this transaction and for other purposes, the Queen's Borough Company has executed a mortgage to the Colonial Trust Company of Manhattan, and has issued bonds in $250,000 of $1,000 each, at five per cent., maturing in 1928. The principal stockholders of the new organization are Royal C. Peabody, Van Wyck Rossiter, Joseph C. Biglin, Frank MacGovern, Isaac M. Sutton and T. S. Williams.

Orange, N. J.—The property and franchises of the Suburban Traction Company were sold at auction by the master in chancery on the 7th inst. The only bid, $100,000, was offered by Col. Charles A. Sterling, of East Orange, representing the new Orange & Passaic Valley Railway Company, and the bid was accepted by the master. Although organized as an independent concern, it is admitted by trolley men that the Orange & Passaic Valley Company is to work in harmony with the North Jersey Traction Company and practically will be under the same general management. The purchase price paid by the Orange & Passaic Valley Company for the road will just cover $67,000 in certificates issued by Watson Whittlesey, the receiver, in whose hands the company has been for three and a half years, about $8,000 interest on same, and $25,000 in costs of court and lawyers' fees. The new company also assumes the payment of $60,000 of first-mortgage bonds, and a guaranteed loan of $150,000 made by the Manhattan Trust Company of New York upon second-mortgage bonds.

ELECTRICIANS IN THE WAR.

Col. Eugene Griffin is at Camp Townsend, Peekskill, organizing the First Regiment of Volunteer Engineers, which he will command. The second battalion is already completed. Company L was mustered in on Friday last. The 2d Battalion of the regiment, organized on Saturday, is composed of Companies E, F, G, H. Major Louis Duncan is commandant of the battalion.

PERSONAL AND MISCELLANEA.

Moses D. Crane, inventor of the fire alarm telegraph, is reported to have taken his own life at Newton Highlands, Mass., on Thursday morning last.

The latest fad among Paris women is the operating of automobile vehicles, and the Duchess d'Uzes has already been arrested and fined for riding at a forbidden speed. To be an authorized driver of one of these machines it is necessary to pass an examination, and large numbers of women are taking the examination, while the tailors are hard at work devising something original in "automobile costumes."

The Pittsburg "Press" states that "J. W. Sweeney, constructing electrical engineer in the employ of the Westinghouse Company, will sail for England July 15, to install the big dynamos and electric light and power plant for the Metropolitan Electric Company of London. The equipment was made at the Westinghouse plant and shipped to London June 20."

The inventor in his researches after the unknown has sometimes to face dangers equal to those that lie in the path of the warrior. Thomas A. Edison, Jr., admits that he is constantly in fear of bodily injury from his experimenting. He has met with several accidents of more or less magnitude already, and he is still almost a youth. "One lesson I have learned," he says, "and that is to be vastly more careful in making experiments. I consider I am a cautious man at all times, but the several narrow escapes I have had make me thoughtful. But I never expect to die a natural death. I feel confident I will be blown up some day. Or failing in an explosion, some sudden shock will pick me off in a wink. I do not see how it can be otherwise if I continue experiments such as I have been carrying on. Caution is absolutely necessary, and exceedingly great caution, but an inventor deeply engrossed in an experiment is the last man to be cautious. He must concentrate his mind severely on the task before him to derive the benefit of the experiment, and when his mind is so closely concentrated his own welfare is the last thing he considers."

According to the Detroit, Mich., "News" the League of American Municipalities will have a gay time when it meets in Detroit next month. The Citizens' Executive Committee has decided to spend $1,000 for a trolley ride and lunch at the water works park, $3,000 for a boat ride up the river, with refreshments, $2,000 for a night trip to Belle Isle with "lemonade" and other refreshments, and $500 for decorations on the city hall. These decorations will comprise festoons of electric lights, and the wiring will be of a permanent character, for use at other conventions. Belle Isle Park will also be decorated with innumerable electric lights in Chinese lanterns. The entertainment estimates are based on cost prices and an attendance of 5,000.

In a hole in the stone retaining wall of a lawn at the northwest corner of Prospect avenue and Independence boulevard, Kansas City, Mo., lives an unusually large and well-fed toad, as we are informed by the Kansas City "Star." "An electric arc light hangs over the corner, and at night it attracts myriads of bugs and flies. It is then that the toad leaves his hole and hops out across the granitoid walk to where the insects, blinded by the light, fall upon the pavement and crawl around. The toad sits, his eyes sparkling in the electric light like beads of jet, till a beetle or a moth falls near him, and then he hops cautiously near to it. His long, red tongue shoots out with the quickness of a flash and the insect disappears down his throat. It takes a good many bugs to make a full meal for this toad, and often he is on the pavement for more than an hour. The toad is there every night and passers by stop to watch him. He keeps out of the way of pedestrians, and when he goes back to his crevice in the stone wall he moves lazily and with short, self-satisfied hops."

RECENT COMPANY ELECTIONS.

Eckington & Soldiers' Home Railway Company, Washington, D. C.—President, O. T. Crosby, president of the Potomac Electric Power Company; secretary, Dana Stevens; additional directors: H. P. Scott, of Wilmington, Del; Thomas J. Haywood, H. A. Parr, Robert Carswell, R. C. Davidson and D. M. Newbold, of Baltimore, and W. K. Schoepf, of Washington, the present receiver of the company.

Franklin Electric Company, Chambersburg, Pa.—President, S. Z. Hawbecker; vice-president, W. Rush Gillan; secretary, G. W. Klee; treasurer, M. L. Ritchey; directors: Hon. W. Rush Gillan, F. B. Shumaker, John G. Orr, G. W. Britsch, S. Z. Hawbecker, G. W. Klee, Van T. Haulman.

Springfield Electric Railway Company, Springfield, Vt.—President, Adna Brown; vice-president and general manager, E. C. Crosby; clerk and treasurer, A. J. Crosby; directors: the officers and M. A. Coolidge, F. E. Coolidge and C. W. Wyman.

Sandusky, Milan & Norwalk Electric Railway Company, Sandusky, O.—President, George H. De Witt; vice-president, Henry Kelley; secretary, J. D. Parker; treasurer, A. W. Prout; directors: G. H. DeWitt, W. H. Gilcher, Jacob Kuebeler, John Whitworth, L. W. Hull, Sandusky; J. D. Parker, T. B. Taylor, Perkins; Valentine Fries, Henry Kelley, J. W. Stoakes, R. Turner, Milan; B. C. Tabor, Norwalk.

COMMERCIAL PARAGRAPHS.

The Babcock & Wilcox Company, New York, report sales for first six months of 1898 in excess of first ten months of 1897. A notable order which they are now filling is that for the 96th street power station of the Metropolitan Street Railway Company, New York. This order for 15,000 HP. Wrought Steel Type Boilers is the largest stationary boiler order ever placed. Previous sales to the Metropolitan Street Railway Company amount to 7,500 HP. Sales to electrical industries in 1898 to this date aggregate 37,511 HP.

INCORPORATIONS.

The Paris Light & Power Company, Paris, Tex.—to manufacture and sell gas and electricity for light, power and heat. Capital stock, $60,000. Incorporators: T. J. Record, J. A. Porter, D. H Scott, J. D. Crook and B. J. Baldwin.

The Ottumwa Electric & Steam Company, Ottumwa, Ia. Capital stock, $225,000. President, J. H. Merrill; secretary, J. B. Sax.

The Central Electric Railway Company, Kansas City, Mo.—to construct and operate about fifty miles of street railway in and about Kansas City. Capital stock, $100,000. Directors: Samuel M Jarvis and Roland M. Conklin of New York City, William C. Skarritt, Edmund G. Vaughan, Frank S. Graves, William M. Reid and Edwin S. Yeomans of Kansas City.

The Adams-Bagnall Electric Company of Grand Rapids, Mich., has certified to an increase of capital stock to $225,000.

The Lamar Electric Light Company, Lamar, Col.—to furnish electric lights and power for the town of Lamar. Incorporators: A. C. Bent, M. Stram and J. W. Bent.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

ELECTRICAL PATENT RECORD.

Letters Patent Issued July 5, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

606,663. Electric Railway. John C. Henry, Denver, Col. Filed March 28, 1898.

606,664. Electric Railway. John C. Henry, Denver, Col. Filed April 7, 1898.

606,711. Trolley-Head. Charles Grover, Kansas City, Mo. Filed Nov. 13, 1897.

606,825. Contact Device for Electric Railways. Charles A. Terry, New York City, and Harry P. Davis, Pittsburg, Pa., assignors to the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. Filed March 2, 1896.

606,826. Current-Collecting Apparatus for Electric Railways. Charles A. Terry, New York City, and Harry P. Davis, Pittsburg, Pa., assignors to the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. Filed April 6, 1896.

606,827. Overhead Construction for Electric Railways. Charles A. Terry, New York City, and Harry P. Davis, Pittsburg, Pa., assignors to the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. Filed June 10, 1896.

606,828. Traveling Contact Device for Electric Railways. George Westinghouse, Pittsburg, Pa. Filed April 6, 1896. Renewed March 16, 1897.

606,917. Electric Brake. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Oct. 22, 1897.

606,990. Electric Railway. John C. Henry, Denver, Col. Filed April 18, 1898.

606,991. Electric Railway. John C. Henry, Denver, Col. Filed April 25, 1898.

606,679. Car-Fender. Otto W. Norling, Brooklyn, N. Y. Filed Oct. 19, 1897.

606,965. Car-Fender Supporting Means. Huibert Grootenboer, Paterson, N. J. Filed April 25, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

606,746. Electric-Light Switch. Frederic L. Temple, St. John, Canada. Filed Oct. 7, 1897.

606,939. Switch for Arc-Lamps. Charles A. Pfluger, Chicago, Ill. Filed Dec. 21, 1896.

ELECTRICAL MACHINERY AND APPARATUS.

606,646. Rheostat. Harry B. Cutter, Philadelphia, Pa., assignor to the Cutter Electrical & Manufacturing Company of New Jersey. Filed June 22, 1897.

606,761. Method of and Apparatus for Generating Alternating Currents. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Societe Anonyme pour la Transmission de la Force par l'Electricite, same place. Filed March 13, 1894.

606,762. Alternating Current Dynamo. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Societe Anonyme pour la Transmission de la Force par l'Electricite, same place. Filed April 19, 1895.

606,769. Electric Heater or Rheostat. Richard Van Renselaer Sill, New York City, assignor of three-fourths to Timothy Cohalan and George N. Chase, same place, and Daniel F. Cohalan, Jersey City, N. J. Filed May 24, 1897.

606,792. Electric Radiator. Frederick W. Quidas, Mount Washington, Md., assignor of one-half to Edward A. Griffith, Baltimore, Md. Filed July 22, 1897.

606,795. Electric Meter. William Stanley, Pittsfield, and Frederick Darlington, Great Barrington, Mass., assignors to the Stanley Instrument Company of Massachusetts. Filed Jan. 13, 1898.

606,819. Contact Device for Electrically Propelled Vehicles. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company, same place. Filed April 6, 1896. Renewed March 16, 1897.

606,863. Alternating-Current Dynamo. Ludwig Gutmann, Peoria, Ill. Filed Dec. 4, 1897.

606,884. Electric Snap Switch. Alfred F. Wood, Philadelphia, Pa., assignor of one-half to John R. Edwards, same place. Filed Oct. 8, 1897.

606,954. Lightning-Arrester. William E. Athearn, Brooklyn, N.Y. Filed Aug. 9, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

606,658. Machine for Punching Telegraph Paper. Godfrey M. Gibson, Chumleigh, England. Filed July 26, 1897.

606,764. Telephone-Exchange. Frank A. Lundquist, Chicago, Ill., assignor of two-thirds to John Anderson, Salina, and Gustaf A. Anderson, Lindsborg, Kan. Filed May 19, 1897.

606,803. Telephone System. Burton R. Dodge, Post Mill Village, Vt. Filed June 17, 1897.

606,832. Telephonic Transmitter. Thomas F. Ahearn, Detroit, Mich. Filed June 19, 1897.

606,865. Police Patrol System. Orlando W. Hart, Fall River, Mass. Filed Aug. 3, 1897.

606,912. Means for Preventing Disturbances in Telephonic Circuits. Otto T. Blathy and Koloman de Kando, Buda-Pesth, Austria-Hungary. Filed April 27, 1897.

MISCELLANEOUS.

606,830. Insulator. Ben Willard, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 18, 1898.

606,887. Electric Extraction of Poisons. John B. Campbell, Cincinnati, O. Filed Oct. 5, 1896.

606,921. Composition of Matter for Electric Heaters. George B. Fraley, Philadelphia, Pa., assignor, by mesne assignments, to Oscar A. Fow and David W. Van Tine, same place. Filed Aug. 12, 1897.

606,981. Process of and Apparatus for Decomposing Solid Substances. William S. Romme, New Rochelle, N. Y. Filed Dec. 18, 1896. Renewed Oct. 26, 1897.

RE-ISSUES.

11,676. Storage or Secondary Battery. Ralph Ashley, Port Republic, N. J., assignor, by direct and mesne assignments, to the Guarantor Electric Company, Camden, N. J. Filed April 9, 1898. Original No. 594,313, dated Nov. 23, 1897.

DESIGNS.

28,981. Cap for Insulators. Ben Willard, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 23, 1898.

28,984. Switch-Contact. Monroe Guett, Hartford, Conn. Filed May 23, 1898.

28,997. Transformer-Casing. James W. Packard and Henry W. Wiswell, Warren, O. Filed May 20, 1898.

TELEPHONE AND TELEGRAPH.

The Independent Telephone Movement.

The Boston *News Bureau* gives the following statement relative to the independent telephone movement in the West, which it credits to Vice-President and General Manager Charles Webster of the Western Electric Telephone Company, who was in Boston last week:

"The Western Electric Telephone system is composed of 3,000 miles of toll lines in operation in Minnesota, Iowa and North and South Dakota. We are putting in copper metallic circuits on all of our trunk lines. We are now building a line from St. Paul to Duluth, Sioux Falls, La Crosse, etc., 1,000 miles in length, and by January 1, 1899, we expect to have 5,000 miles of wire in operation.

"Our system is composed of the Union Electric Telephone Company, capital $100,000; Minnesota Central Telephone Company, capital $100,000; Western Electric Telephone Company, capital $100,000; Western Minnesota Telephone Company, capital $30,000, and Southern Minnesota Telephone Company, capital $30,000.

"After a year's fight independent companies have obtained franchises in St. Paul and Minneapolis, where the Northwestern Telephone Exchange Company, a sub-company of the Erie Telephone Company, operates. In Minneapolis we have organized the Minnesota Mutual Telephone & Telegraph Company, with $300,000 capital, and the company already has between 5,000 and 6,000 subscribers on five-year contracts, on the basis of $48 per year for long distance instruments. The Northwestern Company charges $6 per month for business telephones and $10 per month for long distance telephones. The new company will not start for a year at least. It is now putting its wires underground.

"The independent telephone movement in the West has assumed large proportions. In St. Louis the Kinloch Telephone Company will soon have one of the finest plants in the country in operation. The new company starts with 6,000 subscribers.

"Our company has the largest independent system in the country, although the oldest of our six companies is but three years old.

"Net earnings have been put back into the property, but the companies are now earning from 8 to 10 per cent. We will begin the payment of dividends at the rate of 4 per cent. on the stock of the Western Minnesota and Minnesota Central companies next month."

The sender of a telegraph despatch, it seems, and not the company, must pay for the tax stamp. In reply to the direct question whether a telegraph company or the sender of a message was expected to pay the stamp tax, Commissioner Scott has ruled as follows: "Section 7 of the war revenue law makes it a misdemeanor for any person to make, sign or issue any instrument, document, or paper requiring stamps without having thereupon the stamp to denote the tax." "This ruling," says W. H. Baker, vice-president and general manager of the Postal Telegraph Company, "is in accordance with previous rulings of the Department upon which our action and instructions were based. The law furthermore makes it obligatory upon telegraph companies to see that these stamps are affixed, and the Government will hold responsible any person failing to comply, and will hold us responsible if we permit messages to be transmitted without stamps." It has been decided that messages over leased telegraph wires, when sent by the lessees, do not require stamp taxes.

The American Long Distance Telephone and Telegraph Company has succeeded in securing right of way for its lines through the principal counties and cities of Southern Illinois, and has begun the erection of its poles and wires. The main line will run from Evansville to St. Louis and a branch will extend from Mascoutah to Cairo. The line between Mount Vernon, Nashville and Mascoutah is already completed and offices will be located immediately. The Southern Illinois district headquarters are at present at Chicago, but it is understood that as soon as the lines are completed the headquarters will be located in St. Louis.

"Among influential leaders of the Trades League," says the Philadelphia *Stockholder*, "there is a project on foot to unite all the independent concerns outside the Bell Company in a strong organization to start a life-or-death contest with the Bell Company in Philadelphia, making this the battleground upon which will be fought out once for all the conflicts which have been raging in a sporadic way for several years past throughout the country."

Under the District appropriation bill, which has now become a law, "it shall be unlawful for any person or any telephone company doing business in the District of Columbia to charge or receive more than $50 per annum for the use of a telephone on a separate wire; $40 for each telephone, there being not more than two on a wire; $30 for each telephone, there being not more than three on a wire, and $25 for each telephone, there being four or more on the same wire." It is understood that the Chesapeake & Potomac Telephone Company will appeal to the District courts to declare the law invalid.

A complete telephone system now connects all the committee rooms of the U. S. House of Representatives. The switchboard is in the long corridor of the basement and 'phones have been placed in forty-nine different committee rooms. The instruments are of the long-distance variety, so that one can converse from almost any room in the Capitol with any other room, with all telephone subscribers in Washington, or with subscribers at distant points. A similar system has been in operation at the Senate end for several months.

Florence, S. C., will soon be connected by telephone with the extreme southeastern portion of the county, a distance of 42 miles. This arrangement is now being perfected, and in a few days Florence, Claussens, Hyman, Forrestville, Savage, Allison and several other small places along the route will be within speaking distance of each other. The system of 'phones to be used will be the "Imperial," which is manufactured by the Mason Telephone Company of Sumter, S. C.

The long-distance telephone line is being extended to Douglas from Nicholls, Ga., on the Waycross Air-Line. The line is being built along the right of way of the Waycross Air-Line extension. Douglas will soon be communicating with Waycross, Brunswick, Thomasville, Tifton and intermediate points by telephone.

The Pennsylvania Electric Company was awarded the contract for furnishing 155 transmitters to be used in the new telephone service which the Police Department of Buffalo, N. Y., is to construct, the company's bid being $3.77 each. The Wilhelm Telephone Company of Buffalo was awarded the contract for furnishing 155 receivers at $2.25 each, 12 adjustable desk sets at $3.50 each, and 18 desk sets for the station-houses at $8 each.

The Southwestern Telephone Company has commenced the building of lines from Texarkana, Ark., to Pine Bluff, Ark. The course of their construction is along the right-of-way of the Cotton Belt Railroad and all towns situated on this thoroughfare will be given a telephone office.

The officers of the Signal Corps with Shafter's army are keeping pace fully in establishing telephonic communication in every direction where the army makes its move. In the captured Spanish intrenchments at Santiago telephones were found in perfect trim, showing that in means of communication at least the Spanish army is quite up to date.

A movement is on at Richmond, Ind., for an independent telephone exchange to compete with the Central Union Company. Robert Cokefair, of Anderson, is promulgating the scheme. A toll station will soon be established at Richmond by the Citizens' Telephone Company.

The Home Telephone Company is booked to occupy the upper stories of a new terminal depot to be built for the suburban electric roads at Cleveland, O. The Home Company has passed into the control of the Everett syndicate, which will erect the building.

The experiment of placing telephones in country farm houses is being tried with success in farming sections of Minnesota. 'Phones have been placed in several centrally located farm houses for the use of the residents and their neighbors.

A telephone company was organized at Wynnewood, I. T., on the 2d inst., whose purpose is to build telephone lines to Roff, McGee, Center, Brady and Foster, giving telephone connections to all country towns of importance.

A Detroit paper states that on September 1 the Detroit Telephone Switchboard & Construction Company will begin work on a 5,000 telephone exchange in New Orleans.

A police telephone system will probably be established in Binghamton, N. Y. The chief officials of the city are considering the matter.

The authorities at Washington have decided that messages over private wires do not require stamps.

New Companies Incorporated.

The Oklahoma Telephone Company, Guthrie, Okl. Capital stock, $100,000.

The Detroit Switchboard & Telephone Construction Company has certified to an increase of capital stock from $100,000 to $250,000.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g, gold; guar., guaranteed; inc, income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N Y.—July 11:						
Albany Ry. Co	100	2,000,000	$1,750,000	1¼ % Q., Feb. '98.	142½	146
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	68	70
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown, Pa.—July 11:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—July 11:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	85	..
Baltimore, Md.—July 11:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '97.	..	72½
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23¼	23½
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—July 11:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	...	..
North Shore Traction Co......com.	100	4,000,000	4,000,000	....	10	14
North Shore Traction Co......pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	72	75
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	85½	86
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	105	106
Boston Elevated R. R.	100	10,000,000			67½	68
Brooklyn N. Y.—July 11:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	201	205
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	55½	55⅝
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	212	213
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	...	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	201	205
Kings County Elevated	....	4,750,000	4,750,000	....	8	..
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	45	48
Nassau Electric Railroad	......	6,000,000	6,000,000	....	35	...
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	74	80
Buffalo, N. Y.—July 11:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	55	60
*Buffalo Railway Co	100	6,000,000	5,370,500	1 % Q. Dec., '97.	80	82
Columbus O.—July 11:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb., '98.	49	50
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—July 11:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—July 11:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	275	280
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12½	13
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	1½
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan., 98.	2 8	220
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	95½	96
jChicago West Div. Ry.......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—July 11:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry.......pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	114¼	114½
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—July 11:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	37	39
Cleveland City Ry	100	8,000,000	7,600,000	¾ %, Oct., '97.	56¾	62½
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	59½	60
Detroit, Mich.—July 11:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100⅛	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	..	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—July 11:						
City Railway Co..............com.	100	1,500,000	1,470,600	1¼ % Q., Jan. 1, '98.	100	102
City Railway Co..............pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	150	155
People's Street Railway	....	1,100,000	....	....	100	..

*Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—July 11:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	3 % S., Jan., '98.	140	--
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	--
Holyoke Mass.—July 11:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—July 11:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	--
Indianapolis, Ind—July 11:						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	27	30
Lancaster, Pa.—July 11:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	..
Lancaster & Col. Electric Ry	...	... ...	87,500	....	..	..
West End Street Railway	...	....	....	....	..	..
Louisville, Ky.—July 11:						
Louisville Ry.................com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	37	38
Louisville Ry.............5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	97½	98
Minneapolis, Minn.—July 11:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	18	23
Twin City Rapid Transit....7 % pfd.	..	3,000,000	1,714,200	1¾ %. Jan., '98.	..	100
Montreal, Canada.—July 11:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	266	267
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	96¼	97¼
Memphis, Tenn.—July 11:						
Memphis Street Railway Co	100	500,000	500,000	....	15	--
New Haven, Conn.—July 11:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000		..	..
Winchester Avenue RR	25	1,000,000	600,000		40	42
New Orleans, La.—July 11:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	146	170
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	1	4
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	5	10
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	32
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	8	88
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	18	22
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	58	54½
New York—July 11:						
Central Crosstown RR	100	600,000	600,000	2½ % Q., July, '97.	250	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Jan., '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98	175	19
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Jan., 98	159¼	159½
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	82¼	84
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	211½	215
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98	180	185
hEighth Avenue RR	100	1,000,000	1,000,000	....	335	350
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q., Feb., '98.	330	36[illegible]
jNinth Avenue RR.........guar.	100	800,000	800,000	....	180	..
kSixth Avenue RR...........guar	100	2,000,000	2,000,000	....	200	210
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q. Feb., '98.	325	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., Jan., '98	172½	...
Third Avenue RR	100	12,000,000	10,000,000	2 % Q., Feb., '98.	175	180
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	60	68
*Union (Huckleberry) Ry	100	2,000,000	2,000,000	....	175	200
Newark N. J.—July 11:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	49	49¼
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	95	205
Pittsburg, Pa.—July 11:						
Allegheny Traction Co	50	500,000	500,000	....	..	45
oConsolidated Traction Co.....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	14¼	14½
Consolidated Traction Co.....pfd.	50	15,000,000	15,000,000	3 %, May, '97.	49	49½
pCentral Traction Co	50	1,500,000	‖1,500,000		...	...
qCitizens' Traction Co	50	3,000,000	‡3,000,000	6 % A.	...	...
rDuquesne Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	8 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	..
Pgh., Allegheny & Man. Trac. Co	50	3,000,000	‖2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry	25	3,000,000	3,000,000	½ %, Jan., '96.	18¼	19
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 97.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	300,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October,

s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—July 11						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	158
Northampton, Mass—July 11						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	168	175
Omaha, Neb.—July 11:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—July 11.						
Paterson Ry. Co	100	1,250,000	1,250,000	....	85	86
Providence, R. I.—July 11						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	61	67
Philadelphia.—July 11:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '97.	43½	45
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—Jan, 10, '98.	65½	66
aFairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3 % Feb. 1, '98.	65	66
Union Traction Co.......... $12½ pd	50	30,000,000	29,930,450	....	18	18⅛
bElectric Traction Co	50	....	8,297,920	....	71⅝	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.97	390	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 97	256	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '97.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	155½	..
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	135	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	87⅜	87⅞
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '97.	...	..
iContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '97.	142¼	..
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '97	175	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '97	90¼	..
jRidge Avenue Passenger Ry	50	750,000	‖120,000	$12 share, July '97.	288	300
iPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '97.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '97.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '97	275	...
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '97	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '97	225	230
Rochester, N. Y.—July 11:						
Rochester Railway Co	100	5,000,000	5,000,000	....	10	12
Reading, Pa.—July 11:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..
kCity Passenger Ry	50	350,000	350,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	†1,000,000	Jan., '98.	64	..
St. Louis Mo.—July 11:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Jan.,98.	122½	125
National Railway Co	..	2,500,000	2,479,000	1½ %, Jan.,'98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000		..	..
Citizens' RR.	100	2,000,000	1,500,000	4 %, Oct., '93.	90	110
St. Louis RR.	100	2,000,000	2,000,000	2½ %, Jan., '98.	95	105
Missouri RR.	50	2,100,000	2,300,000	1½ % Jan., '98.	170	172½
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry..........com.	50	500,000	500,000		57	60
Southern Electric Ry.......6 % pref.	100	1,000,000	1,000,000	1½ %, Jan., '98.	108	110
St. Louis & Suburban Ry	100	2,500,000	2,500,000		55	56
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—July.						
California St. Cable RR.	100	1,000,000	600,000	50c. monthly.	107	108
Geary Street Park & Ocean RR.	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅛	53¼
Presidio & Ferries RR.	100	1,000,000	550,000		..	8½
Scranton, Pa—July 11:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	..	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—July 11:						
Springfield Consolidated Ry	100	750,000	750,000		...	11
Springfield O.—July 11:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—July 11:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—July 11:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	96¾	97¼
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	266	267
Washington, D. C.—July 11:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	73¼	74
Columbia Ry. Co	50	400,000	400,000	6 % A.	76¼	78
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	..	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	121	123
Worcester, Mass.—July 11:						
*Worcester Traction Co........com.	100	8,000,000	8,000,000	....	15½	17
*Worcester Traction Co......6 % pfd:	100	2,000,000	2,000,000	3 % S., Feb., '98.	95	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—July 11:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—July 11:						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., Jan., '98.	274	274½
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	68¼	69
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Feb. '98.	131	132
New York.—July 11:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	94¼	95
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1¾ % Q.	101	103
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	160	180
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	44
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan.., '98.	68¼	69
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	109½	111
*International Ocean Tel Co.guar 6%	100	8,000,000	......	1½ % Q.	108	111
Mexican Telephone Co	100	2,000,000	......		.57½	.60
*New York & New Jersey Tel. Co.	100	5,000,000	8,723,000	1½ % Q., Jan., '98.	150	151
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	72	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	85	...
†Commercial Union Telegraph Co	25	500,000	500,000	8 % S., Jan. 1 '98.	110	113
Western Union Telegraph Co	..	......	97,870,000	1¼ %, Jan., '98.	93¼	95⅛
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—July 11:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	170¼	178
Chesapeake & Potomac Telep. Co.	100	......	......	....	59	..
Chicago Telephone Co	100	......	......	......	202	..
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	..	..
Empire & Bay States Telegraph Co.	...	......	......	....	70	76
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	70	72
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	110	115
Providence (R. I.) Teleph. Co	50	....	......	....	87½	..
Southern New Eng. Teleph. Co	100	8,000,000	......	....	120	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—July 11:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
General Electric Co...........com.	100	40,000,000	30,460,000	2 % Q., Aug., 1893.	39½	39¾
General Electric Co.............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	94	96
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	24	25
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Feb., '98.	54½	55
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—July 11:						
Edison Elec. Ill'g Co., New York.	100	9,138,000	7,938,000	....	131	135
*Edison Elec. Ill'g Co., Brooklyn.	100	4,000,000	4,000,000	1¼ % Oct., '97.	119	..
Edison Ore Milling Co	100	......	......	....	10	13
Edison Electric Storage Co	..	......	......	....	22	25
General Electric Co...........com.	100	40,000,000	30,460,000	2 % Q., Aug, 1893.	89½	89¼
General Electric Co.............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	94	96
Interior Conduit & Insulation Co.	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co....pfd	..	......	......	....	..	..
Pittsburg, Pa.—July 11:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	127	..
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—July 11:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	31½	81¼
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	84	35
*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	..
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$32500 dis. Jan.11'97	13¼	14
Southern Elec. Light & Power Co.	10	187,500	187,500		15	..
Miscellaneous.—July 11:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co.	25	500,000	......	......	32	37
Missouri-Edison (St. Louis)....com.	..	......	......	......	14	17½
Eddy Electric Mfg. Co	25	......	......	......	...	18
Hartford (Conn.) Elec. Light Co	100	850,000	......	......	122	180
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	......	6	11
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	......	165	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	82	90
Rhode Island Elec. Protec. Co	100	......	......	......	110	120
Royal Elec. Co. (Montreal)	..	1,000,000	......	2% Q	*157½	159
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	136	137½
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	......	100	110

*ex d.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—July 11:						
American Electric Heating Co	50	10,000,000	....		.06	.07
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	..	..
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	80	85
New York.—July 11:						
Consolidated Electric Storage Co	...	......	....	....	18	20
Edison European	..	......	....	....	1	8
Safety Car Heating & Lighting Co.	100	......	....	......	96	100
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	80	38
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	90	92
Philadelphia, Pa.—July 11:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	..	25½
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	82½	..
Welsbach Light Co	5	525,100	......	....	61½	61¾
Welsbach Light Co., Canada.	5	500,000	......	....	..	2
Pittsburg, Pa.—July 11:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	110	112
Miscellaneous.—July 11:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	10	15
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	60	67
Billings & Spencer Co	25	......	....	....	..	41
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	30	35
Johns-Pratt Co	100	......	....	....	..	112
*Pratt & Whitney Co..........com.	100	......	....	....	4	8
*Pratt & Whitney Co...........pfd	100	......	....	....	45	50
Stillwell-Bierce Co............com.	..	......	....	....	70	80
Stillwell-Bierce Co.............pfd.	..	......	......	2 % Sept. 1, '97.	107	109
Shultz Belting Co	100	500,000	......	....	60	[illegible]
St. Charles Car Co	--	......	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Albany, N. Y.						
Date of Quotation—July 11, 1898						
The Albany Ry.............1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*111	......
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....
‡Watervliet Turnpike & RR. 1st mtg. 6s	350,000	350,000	1919	M. & N.	*117½	....
‡Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..........1st 5s	....	....	......	......	*105	105½
†Interest guar. by Albany Ry. Co.						
‡Principal and interest guar. by Albany Ry. Co.						
Baltimore Md.						
Date of Quotation—July 11, 1898						
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	116
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	......
Baltimore Trac. Co.. Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	102½	103
Bal. Trac. Co.. No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	114½	115
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	101½	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s.	96,000	117,000	1912	J. & J.	110	....
‡Central Pass. Ry. Co.. Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	113	116
City & Suburban Ry......1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	113¾	114¼
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	110	....
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	117	119½
†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.						
‡$151,000 in escrow to retire 1st. mtg. bds.						
Boston, Mass.						
Date of Quotation—July 11, 1898.						
†Lynn & Boston RR........1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	101½	105
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104	....
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	....
†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						
Charleston S. C.						
Date of Quotation—July 11, 1898.						
†Enterprise Street RR........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....
†Controlled by Charleston St. Ry. Co.						
Chicago Ill.						
Date of Quotation—July 11, 1898.						
Chicago City Ry...........1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101⅞	102½
†Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1905	F. & A.	103¼	....
†Chicago Passenger Ry.....Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T...........4½s.	1,500,000	750,000	1907	J. & J.	....	.....
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	104½	......
Lake Street Elevated RR.. 1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	69	70
Metrop. W. Side Elev. Ry.. 1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	45	48
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	103	....
North Chicago City Ry.......consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	....
West Chicago St. RR.........1st mtg. 5s.	4,100,000	8,969,000	1928	M. & N.	103	104
West Chicago St. RR..........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100	100¼
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	90½	91¼
§W. Chicago St. RR. Tunnel.. 1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	102	....
†Redeemable at option on 60 da. notice.						
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.						
¶Subject to call after Oct. 1, 1899, at $110 and interest.						
‖Assumed by W. Chi. RR. Co., lessee.						
§Int. guar. by W. Chicago St. RR. Co.						
Cincinnati, O.						
Date of Quotation—July 11, 1898.						
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	99	101
*Mt. Adams & Eden P'k In...1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	.....
†Mt. Adams & Eden P'k In....1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	......	108½
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	......	119
‡So. Cov. & Cin. St. Ry.........2d mtg. 6s.	400,000	400,000	1932	J. & J.	129½	......
†Assumed by the Cincin. St. Ry. Co.						
‡$250,000 reserved to retire 1st mtg. bds.						
Cleveland, O.						
Date of Quotation—July 11, 1898.						
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	106	107
Cin. New't & Cov. St. Ry... Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	99	101
Cleveland City Cable Ry......1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	100	102
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	100	103
Columbus (O.) Cent. Ry... 1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
aEast Cleveland RR............1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	104½	105
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids....1st mtg. 5s.	600,000	600,000	1912	J. & D.	......	....
†$1,900,000 in escrow to retire bonds of absorbed companies, marked a.						
‡Interest guar. by Cons. St. Ry. Co.						
Detroit, Mich.						
Date of Quotation—July 11, 1898.						
†Detroit Citizens' St. Ry.....1st cons. 5s.	7,000,000	3,835,000	1905	A. & O.	96¼	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	99	100
†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						
New Haven Conn.						
Date of Quotation—July 11, 1898.						
New Haven St. Ry..........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 6s.	100,000	94,000	1909	M. & S.	102	....

*With interest. *Unlisted.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Orleans La.						
Date of Quotation—July 11, 1898.						
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR.............1st mtg. 6s.	......	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	75½	77
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	108	111
†N. Orl's City & Lake RR.. 1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	98¼	99¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	110	....
Orleans Railroad Co..........Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	98½	100
‡St. Charles St. RR. Co.......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	104	....
†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
‡$90,000 outstanding.						
New York.						
Date of Quotation—July 11, 1898.						
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105⅛	109
†Atlantic Av. (Brooklyn).. Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	105½	106
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave...........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave...........2d mtg. 5s.	500,000	500,000	1914	J. & J.	110	112
Broadway Surface..............1st mtg. 5s.	1,125,000	1,125,000	1924	......	114	116
Broadway Surface..............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106⅛
Brooklyn City RR. Co.. 1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	112	115
Brooklyn City & Newtown.. 1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114⅛	115⅜
¶Brooklyn, Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	87
Brooklyn Heights RR.........1st. mtg. 5s.	250,000	250,000	1941	A. & O.	103	....
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	106⅛	108
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit..........gold 5s.	7,000,000	5,181,000	1945	....	104	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	101	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	111½
Central Crosstown RR.........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118⅛	122
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	114¼	116⅜
Dry Dock, E. Bd'y & Bat'y RR.. scrip 5%.	1,100,000	1,100,000	1914	F. & A.	100	*103
Eighth Av. RR. Co........Cert. indebt. 6%.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av.. 1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	113	116
42d St., Man. & St. N. Av.. 2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	95
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	117⅛	120
Metropolitan St Ry Co...g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	114¼	115
Second Avenue Ry...Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	107	109
Second Avenue Ry................Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.)........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co............1st mtg. 5s.	350,000	350,000	1919	......	107	....
Third Avenue RR............1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	121	122½
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	103	108
Union (Huckleberry) Ry......1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	112	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	109	....
†$1,035,000 in escrow to retire gen. mtg. bonds.						
‡$4,850,000 in escrow to retire maturing obligations.						
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.						
§In treasury, $80,000.						
‡‡ Guar. by Union Ry. Co.						
Toronto Canada.						
Date of Quotation—July 11, 1898.						
Montreal St. Ry.................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry...........1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....
†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.						
Philadelphia.						
Date of Quotation—July 11, 1898.						
Continental Pass. Ry...........1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry.................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	....	102	103
Phila. City Passenger Ry.......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co.........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry.........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry.............1st mtg. 5s	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...........Col. tr. 4s	29,735,000	29,724,876	1945	A. & O.	....	....
West End Passenger Ry..........1st mtg. 7s	....	....	1905	......	....	....
West Phila. Pass. Ry..........1st mtg. g. 6s	250,000	246,000	1906	A. & O.	115¾	....
West. Phila. Pass. Ry...........2d mtg. 5s	750,000	750,000	1926	M. & N.	116	116¼
§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Pittsburg, Pa.						
Date of Quotation—July 11, 1898.						
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	88	......
Central Traction Co..............1st mtg. 5s.	375,000	375,000	1930	J. & J	......	......
Citizens' Traction Co............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	107	107½
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	....	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	....	......
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	105	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	......
Pittsburg Traction Co...........1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	......
Pittsburg & Birmingham.........1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	....	103
Pittsburg & West End........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch........Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	111⅛	112⅜
Second Ave. Traction Co....................5s.	2,500,000	2,000,000	1934	J. & D.	......	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....
Providence R. I.						
Date of Quotation—July 11, 1898.						
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107
St. Louis.						
Date of Quotation—July 11, 1898.						
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	100	101
Cass Ave. & Fair Gds. Ry.......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter.. 1st 6s	1,000,000	1,000,000	1913	J. & J.	111	113

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—July 11. 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	$50,000	$50,000	1908	J. & J.	97	100
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co........................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	106	107
Missouri RR. Co........................	1,000,000	700,000	1916	M. & S.	106	107
‡Mound City RR. Co..............1st mtg. 6s.	400,000	800,000	1910	A. & O.	102	104
People's RR. Co......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
∥People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co..................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	100	102
St. Louis & Sub. Ry................Income 5s.	300,000	800,000	......	....	60	64
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110	111
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	103	104
Union Depot RR. Co.........Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
∥$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation— July, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	8,000,000	1918	J. & J.	127	129½
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
†Park & Cliff House RR........1st mtg. 6s.	350,000	850,000	1912	J. & J.	108½	......
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	110	115
†Powell St. Ry........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109¾	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—July 11, 1898.						
Belt Ry. Co........................[illegible] mtg 5s.	500,000	450,000	1920	J. & J.	45	....
Columbia Ry.............................. mtg. 6s.	500,000	500,000	1914	A. & O.	118	....
Eckington & Soldiers' Home. mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—July 11. 1898,						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	109	111
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	107	109
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	101	104½
∥Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	....	......
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	110½	111
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	89	93
††No. Hudson Co. Ry. (N.J.).Cons. mtg. 5s	3,000,000	2,378,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	112	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	95*	....
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	......	89	92
St. Paul City Ry........................Deb. g. 6s.	1,000,000	1,000,000	1900	......	85	92½
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
∥$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—July 11, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	108	....
Pittsburg, Pa.						
Date of Quotation—July 11, 1898						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	105	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(July 11, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	110	...
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	115½	......
Edison Elec. Illg. Co. (Brooklyn)........	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	108	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1923	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	75	90

TELEPHONE AND TELEGRAPH.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—July 11, 1898.						
American Bell Telephone.....................7s.			1898	F. & A.	100¼	....
Northwestern Telegraph Co.................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	108	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108½	....

ALLIED INDUSTRIES.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—July 11, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co.....................	....	....	......	......	......	25
*Barney & Smith Car Co....................†6s	....	......	1942	J. & J.	95	100
Carborundum Mfg. Co.......................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co............................	75,000	......	......	......	....	....
*Unlisted †Nominal.						

NOTES FOR INVESTORS.

In this column, June 15, appeared a paragraph containing the statement referred to in the subjoined note. It was based upon an item in the financial columns of a Philadelphia paper and we had no reason to doubt its authenticity:

"Streatham Hill, London, June 23, 1898.—Your issue of June 15 states that the British Electrozone Company paid 25 per cent. in dividends upon a capital of $5,000,000 in 1897. May I inform your readers that 'Burdett's Official Intelligence' contains no information concerning the company (a bad sign), and that the company is now in course of voluntary liquidation.—JOHN B. C. KERSHAW."

Late quotations for copper are: Electrolytic, 11⅛@11⅜c.; Lıke, 11⅞c.; casting, 11⅛@11⅛c.

The Columbus (O.) Street Railway Company has declared a dividend of 1 per cent., payable August 1.

The plant of the Cincinnati Electric Light Company, according to a press dispatch, was destroyed by fire on the 8th inst. Loss over $100,000.

The Brooklyn (N. Y.) City Railroad Company has declared a dividend of 2½ per cent., payable July 15 to stock of record July 9. Books reopen July 16.

The stockholders of the New England Telegraph & Telephone Company on recommendation of the directors have voted to increase the capital stock of the corporation from $12,000,000 to $15,000,000.

At the last meeting of the directors of the United Securities Company, Boston, Arthur Perry, vice-president and general manager, and Allston Burr, treasurer, resigned their respective positions, the resignations to take effect September 1 next.

The gross passenger receipts of the North Chicago Street Railway Company for June were $253,569, against $238,779 last year, an increase of $14,790. For six months the earnings have been $1,407,942, against $1,326,155 last year, an increase of $81,787.

The Boston "News Bureau" asserts that the statement that President C. A. Coffin of the General Electric Company had been elected a member of the General Electric preferred stockholders' committee is erroneous. Nobody has as yet been appointed on the committee to succeed Mr. Samuel Carr, resigned.

President H. C. Payne of the Milwaukee Street Railway Company announces that the company will spend $1,000,000 on improvements this year. The line will be extended to the Milwaukee suburbs and resorts over a radius of 30 miles. A new power house is being erected for the Wauwatosa line.

In regard to equipping the Manhattan Elevated road of New York with electricity, Mr. Russell Sage says the subject is being considered, but will not be decided until Mr. Gould's return. He pronounced the statement that the General Electric Company had secured the contract untrue.

The City Passenger Railway Company of Baltimore have decided to issue $1,000,000 additional capital stock. Stockholders will be given the privilege of subscribing to the new stock, par $25, at $50 a share, at the rate of two shares for each five now owned. This will increase the stock debt of the company to $3,500,000.

The Philadelphia "Times" says: "The latest report about the North American Company is that a strong party (not Mr. Villard) wants to get control, so as to use the liberal charter for a parent company for surface railroad lines, including some New York and Brooklyn systems."

The directors of the Providence & Taunton Street Railway Company have petitioned the Railroad Commissioners for permission to increase the capital stock of the company from $160,000 to $175,000. The Commissioners will give a hearing to the parties in interest at their office, 20 Beacon street, Boston, on the 14th inst.

The Citizens' Street Railroad Company of Indianapolis has filed a mortgage extending to June, 1900. It was for the payment of $700,000 of bonds held by the Illinois Trust & Savings Company and S. J. Fletcher, trustees. The original issue of the bonds was in 1892 and they were made payable in four years. In 1896 they were extended until 1898. Of the amount $100,000 has been paid.

The annual meeting of the Welsbach Light Company was held at Gloucester, N. J., on Friday last, William Findlay Brown presiding. The annual report shows: Net earnings, $475,207, increase $12,130; dividends, $412,745; depreciation, $14,191, decrease $2,224; balance, $48,260, increase $11,365; total undivided profit, $149,852, increase $47,260; charged off patent account, $30,387; surplus, $119,465; increase $17,873.

The Louisville "Post" of the 4th inst. says: "The reorganization of the New Orleans Traction Company has been postponed for another six months. This is because the company has just paid its semi-annual dividend of 2½ per cent. on the $3,000,000 of bonds. The reorganization committee, which is composed mainly of Louisville capitalists, endeavored to have the company default on the July interest in order to push the work of reorganization, but, as stated above, a failure was made of this."

A report is in circulation that the new Kings County Electric Light & Power Company is negotiating for the acquisition of the property and franchises of the Edison Electric Illuminating Company of Brooklyn, N. Y. If the deal is consummated, it will place the Kings County Company in possession of almost the complete electric lighting field of the Borough of Brooklyn. Among those said to be interested in the Kings County Company are Roswell P. Flower, Anthony N. Brady, William Berri, Seth L. Keeney and Felix Campbell, president of the People's Trust Company.

The foreign demand for electrical equipment for railroads and power stations, according to parties in a position to know, will be more active in about two or three months. Estimating on new work is extensively under way to a greater extent with electrical engineering concerns having branch offices in London and Hamburg, where the majority of large foreign contracts are usually closed. As American manufacturers of such equipments are successfully competing in every part of the world, it is more than likely that a good share of the work now being estimated for will be secured by our manufacturers.

The Quebec, Charlevoix & Montmorency Railway Company has taken over the electric railway system of the Quebec District Railway Company. The bonds of the amalgamated concerns, amounting to $1,500,000, were sold to Hansen Bros. of Montreal, who have paid for some $1,150,000 of the issue. The remaining $350,000 of the bonds are to be used for further extending the present city electrical system, and electrifying the steam system of the Quebec, Montmorency & Charlevoix Railway, so that in the near future pilgrims and others will be able to visit the shrine of St. Anne de Beaupre by electric cars.

The directors of the Kings County Traction Company will sell at public auction, at the New York real estate salesroom, 111 Broadway, New York, on July 14 the assets of the company as follows: 39,987 shares of the capital stock of the Atlantic Avenue Railroad Company of Brooklyn, and options upon the remaining thirteen shares of said capital stock, and also options upon nine shares of the capital stock of the Brooklyn, Bath & West End Railroad Company. All of these shares and options are now deposited with the Central Trust Company, subject to the terms of an option agreement, dated April 4, 1898, executed between the Nassau Electric Railroad and the Brooklyn Traction Company, and are to be sold subject thereto. The sale is preparatory to the winding up of the company's affairs. When it is completed the Nassau Company's new stock and bonds will probably be ready for listing on the exchange.

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CONTENTS.

EDITORIAL NOTES.

A New Form of Range-Finder.

At the present day the aiming of a sea-coast gun at a vessel is an exact science. In the days of smooth-bore, cast-iron guns immense quantities of metal were fired at long range more or less by guesswork, in the hope that at least a small portion of it might hit the target. Since the introduction of smokeless powder all this has been changed. The range and the direction of the target are now computed by delicate electrical instruments known as range-finders, which make correct allowances for the rise and fall of the tide, the direction and force of the wind, the curvature of the earth and many other seemingly unimportant variations. An entire fleet of naval vessels may now be destroyed by the guns of batteries whose commanders fire without seeing a single ship, but who are informed over a telephone or telegraph wire of the exact position of every vessel of the fleet. Range-finding, as is now generally known, is merely an application of an elementary principle of trigonometry applied to surveying. The range-finder which has up to the present been generally used by the Government is that invented by Lieut. Bradley A. Fiske, and which gives the distance of an object from a ship by the aid of an electric current working through two rheostats and a Wheatstone bridge. Observers at the bow and stern of a ship follow the target with telescopes mounted on pivots. The turning of the telescopes varies the resistance of the rheostats and the changes in the intensity of current move a range indicator in the Wheatstone bridge. Of late, however, a new form of range-finder has been extensively adopted for coast service, the Government having purchased some two hundred of these instruments. These latter, known as the Lewis depression range-finders, calculate distance by a method of triangulation, the height of the instrument above sea level forming the base of a triangle. All the depression finders are so constructed that the movement of the telescope as the observer follows the target moves the range indicator about a graduated scale, and thus it is only necessary to glance at the scale to know the range. The advantages claimed for the depression finder are that but one observation station is needed, and in the event of an instrument through any mishap giving out, a reserve instrument may quickly be set up in its place. The Lewis depression position finder is generally believed by army officers to be the most accurate instrument of the kind yet devised. It is claimed to have a maximum error not exceeding 1 per cent. up to 10,000 yards.

The instrument consists of a polished iron table some four feet in diameter, which rests upon an iron column and supports a pivoted traversing arm carrying all the other parts of the instrument. In front the arm has an upward curve which acts as a support for the horizontal axis of a forty-inch telescope magnifying twenty-five diameters. The telescope may be raised and lowered by a crank operating a carefully adjusted mechanism at the eye end. It is swung around in azimuth by a larger crank turning the traversing arm about on its pivot.

By revolving the traversing arm the friction roller of the azimuth-measuring device is turned. Each revolution of the roller corresponds to a given number of degrees of the azimuth. This mechanism is located behind a square sheet of metal, placed vertically just under the eye end of the telescope. Through one opening in the sheet the operator reads the degrees and through another the minutes of azimuth. The screw by which the telescope is raised and lowered meshes with the gear of a horizontal range wheel, one foot in diameter, projecting from under the table below the azimuth reader. There are 600 teeth on the circumference of this wheel. A white sheet of celluloid, one-sixteenth of an inch in thickness, is set into the wheel and graduated about its circumference in black. The range of an enemy's vessel entering a harbor would be taken every ten seconds by means of an electric clock which strikes the intervals. As it is essential that the Lewis depression finder should be made perfectly level before being used, so that the traversing arm may be swung about without changing its horizontal position, this form of instrument cannot be adopted on shipboard owing to the constant movement of the vessel, and the Fiske range-finder will undoubtedly be continued in use on vessels of the navy.

* * *

The Paris Exposition of 1900.

From all accounts American manufacturers of electrical machinery will have an opportunity of furnishing the Paris Exposition of 1900 with electrical machinery to the value of $1,000,000, in spite of the rumor which was current not long ago that owing to the stand the French nation had taken on the war question this country would refuse to be represented at the Fair. Mr. Louis M. Hamburger, who some time ago was appointed a special commissioner to visit Paris and look over the ground, on his return is credited with having made the statement that the French Government evidently desired to cultivate the friendship of America, and that while Germany and Russia had each appropriated $1,250,000 to defray the expenses of a display at the Exposition, this country had as yet made no appropriation or even appointed a permanent commission, yet in spite of this fact the French Exposition authorities had defined the space America would

have. The New York *Times* credits Mr. Hamburger with the following statements which would seem to give a very clear idea of the situation :

"Before leaving Paris, I saw statements in American papers that Americans in Paris were subjected to annoyance there; that they were elbowed off the sidewalks, etc. I saw nothing of that myself. I met with no evidences of hostility and found no well-informed person that doubted the ultimate success of the American arms. The money spent by the Government for the Exposition will be in the nature of an advertisement for American goods, and a larger foreign market for our goods will be most agreeable after the drain upon our resources inflicted by the war. The concessions obtained from the Exposition authorities in the interest of American electrical machinery, and a definite guarantee of display space such as has been granted to no other country, are good evidences of French friendship with us."

That America should be well represented in the electrical line at the Exposition of 1900 goes without saying, and there is also not the slightest doubt but what a fine exhibit of electrical apparatus would greatly tend to increase our exports to Europe as well as to South America, as Paris is still the great center where converge the commercial and financial interests of the Latin races.

* * *

The Electric Arc. The electric current, as is well known, has already been extensively employed in welding the ends of trolley rails, thus making them continuous with a view to decreasing the resistance of the return circuit and preventing to some extent electrolysis. The rails are made continuous usually by what is commonly known as a portable electric welding car. The latter is provided with the necessary electrical equipment, and may be moved from point to point along the track. On reaching a rail joint which it is desired to weld, an arm is let down and attached to the rails at that point in such a manner that when an electric current is turned on an arc is formed between the rail ends, thus fusing the molecules of steel together. A car of this description has been a familiar sight in Brooklyn, where miles of rail joints have been welded by this method. A similar line of work is also being carried on by a firm in Western Pennsylvania where track junctions or frogs for railway crossings are electrically welded. Recently, however, new uses have been found for the electric arc which, in view of our war with Spain, are exceedingly important. The welding process has lately been adopted by the Government in the manufacture of shells for both the navy and army. Heretofore the projectiles were made of cast-iron or steel by an exceedingly costly process. Now a shell is made in two portions, the point of very high carbon steel, the base of ordinary machine steel, and the two are electrically welded together at a comparatively slight expense. The electric arc now also plays an important part in the construction of our men-of-war. A short time ago it was an extremely tedious and difficult piece of work to bore a hole in the harveyized plates which are used as an outer protective skin on the ships of our navy. These sheets of metal are on the surface almost of the hardness of glass and as hard as the steel drill which is used to perforate them. Under these conditions it will readily be seen that to bore a large number of holes in a harveyized plate by means of a drill would entail an immense amount of time and labor. This tedious process has now been done away with and the electric arc substituted. By means of a specially designed apparatus, a hole may be fused through this hard steel surface almost in an instant.

Another comparatively recent application of the arc is the closing of blow-holes in castings. This is accomplished by heating the casting red hot and connecting it to one pole of a dynamo, a metal bar being connected to the other pole. The bar on being held to the blow-hole causes an arc to be formed which fuses the adjacent parts, thus closing up the blowhole. The electric arc is also quite extensively used at the present time for fusing together the ironwork of high buildings, and is also used to some extent by the larger manufacturers in joining the hard and soft parts of steel and iron tools. In short, at the present time there would seem to be scarcely a department of metal-working to which the electric welding process cannot be applied with a saving of both time and money.

Under the Searchlight.

Notes and Comments on Various Topics.

The Brooklyn Electric Light "Combine."

The fact that the Kings County Electric Light & Power Company had absorbed the Edison Electric Illuminating Company of Brooklyn was made public on the 16th inst. by the following circular letter :

Brooklyn, N.Y., July 15, 1898.

Mr. George Foster Peabody, of the board of directors of the Edison Electric Illuminating Company of Brooklyn, acting in consultation with the officers, has to-day closed, in behalf of stockholding interests represented by his firm, and equally for all others, a proposed sale of the stock of this company to the Kings County Electric Light & Power Company, upon terms which the members of the board of directors unite in thinking for the permanent advantage of the stockholders. Counsel are preparing the papers in detail to carry out the agreement, provided it shall be accepted by two thirds of the stockholders.

As soon as these details are in proper shape the matter will be fully submitted to each stockholder of record. The result to the stockholders will be in substance that the right to subscribe to 25 per cent. additional stock, at par, will be secured to them, and that for the whole amount of stock they will then be offered par in ninety-nine-year 6 per cents. Purchase money mortgage bonds to be secured by the deposit of the Edison stock so sold, and additionally by a junior mortgage of the Kings County Company upon its property, and further by a deposit of a guarantee fund of $1,000,000.

This prompt preliminary notice is sent at once, and full information will be sent promptly upon completion of the papers during August ETHAN ALLEN DOTY.

That the amalgamation of these two companies has at last actually been consummated does not surprise us in the least, as ELECTRICITY more than a year ago predicted that such a consolidation would take place. The stockholders of the Edison Electric Illuminating Company may find that after all it is simply a case of "out of the frying-pan into the fire." When will this constant manipulation of electric securities cease?

* * *

An Engineer's Heroism.

A WILD Indian, says the Macon, Ga., *Telegraph*, is something awful, but a wild engine is about as terrifying a contrivance as a man could think of. Imagine a huge steam giant, with power enough to run away with a freight train, tearing about in a power house, its governor strap broken, its huge arms making several hundred revolutions a second and smashing everything within reach. Such was the scene in the central station of the Macon Consolidated Street Railroad Company a few days ago. The engine was a stationary one of great power and was one of those used to generate electricity for the street car company. When its governor strap broke, and before the engineer, W. M. Brevard, could reach it, the governor had blown wide open and the increased speed had thrown it on its side. In spite of the escaping steam, mud and pieces of iron which filled the air, Brevard, at the risk of his life, seized the governor and shut off the steam. As it happened, only five or six hundred dollars' damage was done and the engine will probably be able to go back to work in a few days.

* * *

ALTHOUGH happily we do not number among our readers, as far as heard from, any person addicted to the use of intoxicating beverages to such an extent as to render him liable to optical delusions of an ophidian nature, some of them possibly may have acquaintances outside of our clientage whose minds they can relieve by communicating to them the following intelligence which we reproduce from a trustworthy source : "In view of the fact that a large majority of the visual hallucinations accompanying cases of delirium tremens consists of the appearance of snakes and worms, a series of examinations with the ophthalmoscope were recently made and brought to light some interesting facts. In sixteen cases examined there was found in every case an abnormal condition of the blood vessels of the retina. Instead of having their usual appearance and being pale and but slightly visible, they were dark with congested blood. Normally, these small blood vessels are so small and semi transparent that they are not projected into the field of vision, but in the case of this disease they assume great prominence, and their movements seem like the twistings of snakes."

* * *

AFTER a recent trolley collision a Scotchman was extricated from the wreckage by a companion who had escaped unhurt.

"Never mind, Sandy," his rescuer remarked; "it's nothing serious and you'll get damages for it."

"Damages!" roared Sandy. "Hae I no had enough. Guid sakes, it's repairs I'm seekin' noo."

* * *

IT must be a rather ludicrous sight to see a man shut in a telephone booth and making vain efforts to get out. Such a scene recently took place in a certain cigar store in Brooklyn, and the hurried business man was obliged to resign himself to his fate until a policeman secured a carpenter who took down the booth and thus restored the captive to liberty.

* * *

MAJOR HENRY M. ADAMS, who has charge of the mine fields in New York harbor, has received from Brig.-Gen. John M. Wilson, Chief of Engineers, a letter of instructions in reference to removing the mines in the harbor. Under these instructions Major Adams is authorized to remove the mines in any channels under his supervision where the interests of commerce demand the removal. He is directed, however, to leave in position the cables, junction boxes, anchors and casemate appliances, so that mines may be planted immediately upon telegraphic instructions from Washington.

* * *

An Electric Love Alarm.

The ingenious father of an estimable young lady in Sheffield, says *Pearson's Weekly*, recently rigged up a clever contrivance by which he discouraged a certain young man who had been accustomed to make love to his daughter. The old gentleman recently caught the young man and girl rather close together on the sofa. He read the girl a lecture and made her promise not to let the young man sit beside her on the sofa again. He was suspicious, and decided not to trust the girl's promise, so he called in an electrician to carry out a little scheme of his. A contact plate was fitted just under the cushion of the sofa and another to the bottom of the frame in such a way that when the weight of two persons bore down upon the top plate it would touch the other and close the circuit. Wires were run from the plate to the old man's bedroom, where as soon as the circuit was closed a small bell would ring. All this was done without the knowledge of the girl. The next night the young man called again, and everything was as it should be until the old folks retired about 10 o'clock. About half an hour later the bell upstairs rang furiously. The old man sneaked down stairs and caught the lovers snuggling very close together on the sofa. The young man escaped with his life, fortunately, but the poor girl is locked up on a diet of bread and water.

ON THE NECESSITY FOR UNIFORMITY IN PLANT AND APPARATUS.*

BY C. H. WORDINGHAM, A.M.I.C.E.,
City Electrical Engineer, Manchester, Eng.

The principles enunciated by Dr. John Hopkinson in his classical paper on the cost of electric supply† are now fully appreciated by the majority of supply engineers, municipal and other, but it is doubtful whether they recognize that their own field of labor is but one very small, indeed insignificant, plot in the wide area to which these principles apply.

Manufacturers of all engineering products have to face the same problem, viz., the production of articles the cost of which is made up of two items, one independent of the quantity sold, the other practically proportional to that quantity.

In the case of manufacturers, the standing charges comprise the establishment of the works, i. e., the cost of land, buildings, engine power, machinery and tools, drawing office staff, patterns, etc.; the establishment of offices, and in many cases of show-rooms, with staff of clerks, travelers, etc.; the holding of a stock to supply the demand without delay; while to these standing expenses must be added the salaries of a number of engineers, managers, etc., who must be ready to design the articles manufactured, and who must be kept up to date in the latest practice, often at great cost.

The running expenses are wages for labor, skilled and unskilled, fuel, oil, etc., for running the works, repairs to machine and other tools, raw material.

Probably no better example of high cost could be taken than the manufacture of submarine cables. In this case both items are greatly exaggerated. A large amount of very expensive machinery occupying great space and extensive buildings has to be provided and kept in good order, to be used perhaps once in the year, and when it is required it frequently happens that the work is of an urgent nature, and manufacturing has to be kept going day and night for a few weeks, necessitating overtime and high rates of wages, together with excessive wear and tear of plant, while the cost is still further augmented by the fact that the cable is probably of a special size and design.

Now let us examine into the means by which the cost of manufacture may be reduced. Assuming that all that is possible has been done to economize by the choice of a site where land is cheap, by suppression of superfluous cost in the erection of buildings, by skilful design to avoid unnecessary handling of goods, by the absence of display in offices, etc., what remains to enable the manufacturer to reduce his cost? One thing pre-eminently, restriction of the number of types and sizes of the articles produced. To produce say a dynamo, machine or an engine, a number of calculations have to be made, then a series of drawings must be prepared, next the patterns, and finally the tools. All this means large expense, and if only one article is made, the whole cost has to be charged to that article, and this standing cost may completely swamp by comparison the cost for material and labor. Whereas, if a thousand such articles were required, the fixed cost, being divided amongst them all, would be only one-thousandth part of what it was in the case of one. By limiting the number of patterns, it becomes possible to devote more time and attention to perfecting the design and the tools necessary for the manufacture, hence higher efficiency is gained in conjunction with reduced costs, for, though the provision of the tools requires a slight addition to the standing cost, it is quite inappreciable when divided among the number of articles sold, and there is a corresponding saving effected in labor.

The subject as a whole is a very wide one, but this paper must necessarily be confined to the particular case of electric supply stations, and the author hopes to be able to show that, even limited to this small area, the question is of great importance.

At present, every engineer in designing a station seems to think it incumbent upon him to have something different in his station to that in every other. One fixes upon some peculiar declared pressure, involving special designs for every lamp, motor, radiator, or other consuming device that is to be attached to the circuit. Another wants alternating current of special periodicity, or transformers of an unusual capacity, or in a case of some unheard of shape. Another wants extra large boilers or dynamos of a capacity different to any stock size. Another requires cables of a size necessitating strands of some odd gauge of wire. No doubt this is not wholly intentional, but arises partly from want of thought, partly from ignorance and partly, it is to be feared, from a feeling that manufacturers are a kind of inferior race, who cannot possibly know as much as the engineer, and who must do as he tells them. Now it is essential to success, both mechanically and financially, that the engineer and manufacturer should mutually strive to secure it; the manufacturer must endeavor to carry out the engineer's objects, and the engineer must subordinate the details of his scheme to the convenience of the manufacturer. No man can know everything thoroughly, and it must be admitted that a manufacturer who devotes his whole time and energy to the production of a particular class of machinery, or apparatus, must know more about that particular class than the engineer with whom it is but one item out of the many comprising his whole scheme. Only those men whose standing in the profession is assured dare to admit and recognize this, the second rate men fear that their doing so will be construed into a confession of ignorance or incompetency.

As an evidence of the want of uniformity now existing, I have made inquiries as to the practice as regards certain points, and through the courtesy of engineers running the stations have obtained the following information. The particulars relate to 109 stations, in 46 of which continuous current is employed, in 55 alternating and in 8 both alternating and continuous.

First as regards declared pressure, the following table gives the number of stations and the various pressures declared :

TABLE A.

Declared Pressures.

Declared pressures.		Continuous current.	Alternating current.
50	Volts.	—	1
50—100	"	—	2
84 - 103	"	—	1
90—100	"	1	—
100	"	8	29
100—200	"	10	10
100—105	"	1	1
102	"	—	2
102—205	"	—	2
105	"	2	1
105 — 210	"	3	1
107 —214	"	1	—
110	"	3	2
110—220	"	8	1
113	"	1	—
115—230	"	1	—
150	"	8	—
200	"	2	4
210	"	1	—
210—420	"	1	—
220	"	4	1
220 — 440	"	8	—
230	"	3	—
	Total	51	58

In addition to the above, a few stations give special pressures for special reasons. One station varies its pressure according as the transformer is made by one or other of two manufacturers. Another which normally supplies at 100 volts supplies at 102 by special arrangement with a "lunatic asylum!" A third supplies at 113 volts, but naively recommends 110 volt lamps. Apparently this station is not run on the same lines as those in which the declared pressure is "102½ volts."

Incidentally, it may be remarked that the permission given by the Board of Trade to vary the declared pressure in different districts is practically never taken advantage of, while as against this, one station in defiance of all Board of Trade regulations, boldly declares a pressure of 420 volts.

The next point of importance in which the practice differs is the question of periodicity in alternating stations. The periodicities are set forth in the following table :

TABLE B.

Periodicities—Periods per Second.

3 at 10	6 at 83
7 " 50	1 " 83.5
1 " 58	1 " 83—100
6 " 60	1 " 87
1 " 67.5	1 " 87.5
1 " 74	2 " 90
3 " 75	2 " 93
1 " 75—80	17 " 100
1 " 77	1 " 125
2 " 80	

Total, 58

The size and pressure of the generators is the next point of interest. It did not appear worth while to tabulate the pressures generated in low pressure stations, as the declared pressure is a sufficient indication of the pressures used. As regards the high pressure generators however, the following table shows the pressures generated :

TABLE C.

High Pressures Generated.

Pressure. Volts.	Continuous. No. of stations.	Alternating. No. of stations.
1000	8	8
1000—1050	1	—
1400	1	—
1800	—	1
1800—2000	1	—
2000	1	35
2000—2100	—	5
2000—2200	—	8
2000—2500	—	1
2050	—	1
2100	—	4
2110	—	1
2200	—	1
2400	—	1
2500	—	2
8000	—	1
Total	7	59

The size of generator is very important, and here again there is a most extraordinary discrepancy in the sizes employed. These are tabulated in Table D. Without entering into the number of machines, which do not very greatly affect the question, the following sizes are in use :

TABLE D.

Size of Generating Unit.

Continuous		Alternating		
KW.	KW.	KW.	KW.	KW.
10	80	20	62	150
12	88	22	66	154
15	90	23	70	160
20	100	25	72	165
25	112	26	75	175
27	120	30	80	180
28	125	32	81	187
30	140	33	82	200
33	150	35	84	210
37	180	36	85	222
40	200	37	88	225
50	210	40	90	250
52	212	44	100	260
60	250	45	110	300
64	320	50	120	850
65	350	55	125	360
66	400	57	130	880
70	600	58	135	890
75	1500	60	140	......

Inquiries as to whether standard sizes of mains, meters, etc., were employed, showed that in many instances such is not the case, the size being chosen haphazard according to requirements.

The above figures will serve to show the utterly chaotic state of central station practice as regards standardization in this country at the present time, and very little consideration is necessary to show that the difficulties to be coped with by manufacturers in consequence must be enormous, and that, for the reasons stated at the beginning of this paper, the price of plant and apparatus to users must be very largely augmented, without there being any corresponding additional profit to manufacturers. The additional cost is in fact pure waste, and benefits nobody.

No doubt it is inevitable, in the early stages of any industry, that there should be great diversity of practice—indeed it is desirable that things should not become stereotyped until the best has been discovered, but we have surely now arrived at a time when we can make up our minds on such subjects as

* Paper read before the Municipal Electrical Association, London, June, 1898.

† See Dr. John Hopkinson's paper on "The Cost of Electric Supply," read before the Junior Engineering Society on the 4th November, 1892.

those enumerated above, and it is of vital importance that the matter should be settled soon, for each new station that is to be built perpetuates its own set of quantities.

The most important point of all is the declared pressure, for this affects every consuming device as well as generators, or transformers if used. While it should be so fixed as to admit of as economical distribution as possible, it should not involve a loss to the consumer in wasteful resistance, or in enhanced price for lamps specially fragile or difficult to manufacture.

The author ventures to think that, taken all round, 100 volts and multiples thereof is the most convenient pressure, and the one most likely to meet with general acceptance. In the first place, it is that most largely used at the present time, and it meets the conditions named above, since two ordinary arc lamps, or one enclosed, can be made to burn steadily at 100 volts, the waste in resistance being reduced to a minimum, while for the first multiple, viz., 200 volts, there is little difficulty in obtaining single incandescent lamps. Moreover, it gives a convenient pressure across the outer conductors, a pressure suitable for tramway working, while allowing a good margin for loss on low pressure feeders, without necessitating a higher pressure at the generating station or transforming station than 500 volts, which is the limit of low pressure fixed by the Board of Trade. Incidentally, 100 volts is very convenient for mental calculations, and for meters when ampere hour instruments are employed.

In passing it may be remarked that a good deal of doubt appears to exist as to the exact meaning of the Board of Trade definition of low pressure, viz., whether 500 volts is the limit at the station or at the network end of the feeder, and an authoritative interpretation of this would be very acceptable.

Other directions in which standardization is necessary may be mentioned here, viz., the adoption of standard candle powers for incandescent lamps. It would appear that no more than four sizes below 100 candle power are really necessary. A little consideration will show that, quite apart from the question of manufacture, the limiting of the number of sizes would enormously reduce the amount of stock that has to be held, and hence a large amount of capital uselessly locked up would be set free.

The number of sizes of arc lamps might very well be reduced. Three would suffice for all ordinary purposes. If this were done, not only would the cost of production be greatly lessened, but the ease of replacement of damaged and worn-out parts, and the cheapening of carbons, together with convenience in obtaining them, would be a great gain.

As regards motors, it is probably not worth while to make anything smaller than 2 horse power, whatever it is intended to drive, except perhaps in the case of ventilating fans. The bulk of the demand will probably be for motors under 25 horse power, and three sizes between this and 2 horse power should suffice.

So long as a supply of alternating current continues to be given to consumers, the question of periodicity will affect the stations concerned nearly as greatly as does the question of declared pressure, and it is therefore as important that some definite understanding should be come to. The variation at present, as will be seen from the table, is as great as or even greater than in the case of pressure.

The question of periodicity will always be an important one, as there can be little doubt that two or three phase current will be generated in many stations in the future, though probably it will not be supplied to customers.

Next in order of importance perhaps is the size of generating unit in the station. It was recently necessary for the author to go into this matter somewhat carefully, and he was astonished to find at what an early period in the development of a central station it becomes possible and safe to employ large units. There are practically four factors governing the choice of the unit of the plant. They are—

(1) The initial capacity of the station.

(2) The probable ultimate capacity.

(3) The steps by which it is permissible to increase the capital expenditure.

(4) The percentage safe overload of the plant.

It may be mentioned here that, in the author's opinion, it is preferable to have reserve plant in the shape of machines with considerable margin of possible overload beyond maximum economical load than in the form of spare machines, for the latter are only of use in cases of actual breakdown, while, in the former case, the reserve is always ready to be called into play at a moment's notice, and there is no delay due to having to start up another machine in case of sudden demand, whether from a running machine having to be switched out or from an abrupt change in weather. Further than this, the same amount of reserve can be attained more economically.

The conditions to be fulfilled then are, that if any one machine breaks down, the remaining machine shall not be overloaded more than a definite amount, say 33 per cent., 25 per cent. or 20 per cent. If the last named figure be adopted, this means that the first installation of plant must consist of six machines of equal capacity; their size will depend on the initial capacity of the station. When extensions have to be made, the increment of plant will depend upon the increment of capital permissible. The condition that any one unit may break down without overloading the plant 20 per cent. allows of either one, two or more machines being added. The amount of increase of capital will be a minimum if only one machine be put down, but this course is open to the serious objection that it means a number of machines all differing in size after the first six, hence absence of interchangeability of plant, and an unsightly station. It would appear most convenient to increase the plant by pairs of machines, since this gives a symmetrical arrangement, allows of reduction of spare parts, and renders the machines convenient multiples of one another. Time does not admit of a particular case being worked out, but if this be done it will be seen that a large size is soon reached, and after a certain point the rule cannot be carried out, as it leads to engines of impracticable size. It then becomes necessary to add each time one or more machines of the same size. It would be a matter of great interest to learn from engine and dynamo builders what is the upper limit of size of generator.

It will thus be seen that we begin with six machines with parts interchangeable, and finish with a certain number of machines depending on the size of the station, also having the parts interchangeable, and between we have a number of machines of varying sizes. In very large stations put down on a sufficiently generous scale, all the units may be of the same size, but the author maintains that the initial number should not be less than that number which allows of one breaking down without overloading the remainder more than the specified amount, and it cannot be considered safe to put down one or two large machines to begin with, and to trust to good workmanship and design to avoid mishap.

On the above principles it should not be a difficult matter to work out a series of machines which will provide for stations of all ranks, and yet be limited in number.

Next may be considered the question of mains, both as regards the conductor and the insulation. It is greatly to be desired that only a few sizes of conductor should be decided upon. The author has endeavored to show elsewhere * that of necessity the size of main required in a given street is largely a matter of guesswork, hence it should not be a difficult matter to agree upon standard sizes that may be such that they can be made up from ordinary S. W. G. wires. If this were done, a manufacturer could afford to stock a great deal of wire, and one source of delay in delivery would be avoided.

Again, it surely should be possible to settle upon standard tests for dielectrics of different kinds for given pressures, and if this were accomplished manufacturers could stock cable actually ready for delivery. The advantage of this will be fully appreciated by central station engineers, for, instead of each one having to store for his own requirements, he would be able to order from stock, and save the expense of cable stores and their attendants, besides being able to meet unlooked for extensions at short notice, while the aggregate stock, and therefore the capital locked up, would be much less than if there were a number of separate stores.

We next come to accessories such as service cables, transformers (in the case of alternating supply), main fuses, meters, maximum recorders, meter boards, etc. Here again the ory must be standardize. Find out the best all round pattern of each, and keep to it. Have as few sizes as possible. Arrange your parts so that they shall come in if extensions take place so that the work may not have to be redone. In his own practice the author has endeavored to carry out these principles, and he has to a great extent succeeded, but it would be tedious to enter into the details.

It is of little use for one or even many individuals to standardize unless there be co-operation. It will probably be said, all admit that uniformity of plant is desirable, and you are but laboring to prove that which is evident. How do you propose that this desirable end should be achieved? The author replies that there is but one way, and that is by settling upon standards that will be acceptable to the majority of those concerned, and this can only be done by thrashing out the subject by a committee thoroughly representative of all classes interested.

This Association is representative of a section of one section only, viz., the municipal section of users of plant, and it is not therefore competent to deal with the matter by itself. The Institution of Electrical Engineers, the mother of all British electrical societies and associations, is the proper organization to which the matter should be referred, and it will doubtless be a matter of satisfaction to the members of the association to learn that our council has already approached the Institution with a view to this, and a committee has been appointed by them to thoroughly go into the question.

The recommendations of the committee cannot fail to carry great weight, and if the matter be properly taken up, uniformity will soon be secured, for it will be found that the firms not making standard plant could not compete with those that did, and users with fads would find them too expensive to indulge.

It may be thought that such a system should be international, but it is to be feared that the difficulties of securing the desired end would be such as to make it impracticable, and it would result in the matter being indefinitely postponed.

* See his paper on "The Distribution of Electrical Energy," read before the Northern Society of Electrical Engineers on the 8th November, 1897.

Electric Haulage Abroad.

It appears that the canals which intersect Ghent are now to be utilized for the first time for extensive passenger traffic. A company has recently been organized, so we are informed, with the object of running barges through these waterways by means of electricity at a very small fare. The canals in the central division of Belgium possess already a system of haulage by electric tricycles which are run on the banks alongside the canals. The canals between Ghent and Bruges and those between Ghent and Termayen are now following suit.

THE RELATIONS BETWEEN THE PURCHASER, THE ENGINEER AND THE MANUFACTURER.*

BY WILLIAM H. BRYAN,
St. Louis, Mo.

When an engineering structure of magnitude is to be erected, what general plan of procedure should be followed in order to insure that the finished work shall be best adapted for the intended purpose and shall involve the minimum investment of capital consistent with proper construction, and the minimum cost of operation and maintenance?

In the erection of buildings, the precedent of placing the work in the hands of a skilled architect has long since become well established. In civil engineering, the construction of railways, bridges and roofs is universally intrusted to engineers. In the newer branches of mechanical and electrical engineering, however, it has only recently become the practice in this country to engage consulting engineers. The principal reason for this has been that there have been heretofore but few specialists who have devoted their attention exclusively to this class of work. The few well-trained men in these fields early connected themselves with manufacturing or contracting companies, or entered into these branches of work on their own responsibility. The natural disinclination of the purchaser to ask for expert advice from an engineer—however competent and experienced—who is known to be interested in the manufacture or sale of some specialty, and whose opinion is not unnaturally open to the suspicion of bias, left him no course but to proceed on his own responsibility, with results which were often as unsatisfactory to the manufacturer as to himself.

This situation has, however, in a large degree changed, owing to the large number of excellent engineering schools, and the very thorough courses of theoretical and practical training which are there given. These, coupled with the large number of trained and experienced men who have been connected with prominent manufacturing and constructing companies, and with the installation and operation of large plants, have now rendered available the services of many men of thorough technical training, supplemented by years of practical experience in actual construction. Many of these have no connection with the manufacturing, selling and contracting interests, and their judgment is not, therefore, open to the suspicion of bias in favor of or against any special manufacturer.

It is becoming more and more the custom, therefore, to place the same confidence in the consulting, mechanical and electrical engineer which has long been reposed in the architect and civil engineer. He is called in at the earliest stages of the development of the enterprise, for advice as to the general outline and arrangement of the scheme, its probable cost, the expense of operation and maintenance, and the returns which may be expected from the investment. He makes a preliminary reconnoissance and report, giving this data. If these are approved, he then makes a more detailed study of the problem, mapping out the general scheme more definitely, selecting the particular system or type of apparatus best suited to the local conditions of service, and preparing general plans and specifications. These he accompanies with more detailed estimates of cost. When these are approved by his principals, proposals are asked for, and when received, the engineer assists the purchaser in canvassing and comparing them and in selecting that proposal—not necessarily the lowest—which seems best to meet the requirements of the work in hand.

The engineer then assists his clients in drawing up the final contracts, supervises the work during construction and makes such final inspections and tests at completion as are necessary to determine whether the specifications have been complied with.

This has long been the accepted custom in England, where the same difficulty of securing competent and unbiased engineers has not been encountered. No trouble has been met with in that country in applying the same rules to these branches of engineering which are universally followed in other fields.

As might be expected in any new department of engineering, however, the relations between the purchaser, the engineer and contractor have not always been harmonious. The manufacturer frequently feels that he has been imposed upon; the engineer is often hampered by incompetent or unscrupulous contractors, and between the two the purchaser himself is sometimes at a loss for a proper solution of the difficulty. While it is true that most contracts of this character are carried through satisfactorily, it must be admitted that misunderstandings are more frequent than they should be.

The discussion of these differences has recently taken tangible form both in this country and England. In the latter country, the manufacturers and engineers recently met, and succeeded in agreeing upon a number of standard clauses for specifications, which removed many of the objections and criticisms from both points of view. It has been suggested that this work of preparing standard specifications would come properly within the province of the national engineering societies, but if these bodies do not take the matter up, something might be accomplished by the engineers and manufacturers getting together for mutual exchange of views, as was done in England.

The present misunderstandings may be traced to a few serious causes. In the first place, the mechanical and electrical fields of work have, unfortunately, been embarrassed by too great a number of incompetent and inexperienced manufacturers and contractors, poorly equipped for good work, and with but limited intelligence and skill. To these have been added a more than ordinarily large percentage of contractors who are not altogether scrupulous as to their methods, and whose object is to finish the work in almost any sort of shape which will pass muster. These incompetent, inexperienced and unscrupulous contractors—though relatively few in number—have detracted from the good reputation of work of this character, and have forced upon the consulting engineer the necessity of inserting in his specifications the most rigid requirements as to the character of workmanship and material, inspections and tests, which would be unnecessary if it were certain that the work would be awarded to contractors of established reputation, ability and skill.

Furthermore, it has been found that some manufacturers are slow to adapt their designs and patterns to advanced and improved practice. Experience having shown the clear and decided superiority of certain designs, the engineer is justified in embodying them in his specifications, in spite of the fact that some manufacturers will attempt to force the use of antiquated forms.

Again, the manufacturers are often careless in making guarantees. Some of them do not hesitate to meet any desired figures, if a competitor does so. Often they will oblige themselves to do what is impossible with the type of machinery they offer, and trust to luck, or careless inspection or testing, to get the work accepted and paid for.

The grievances of the manufacturers have recently taken shape in papers and discussions in the electrical press and may be briefly summarized as follows:

First—That the engineer appears unwilling to receive suggestions or advice from the manufacturers, as such action might detract from the "dignity" of his position, and that specifications, therefore, often contain many annoying and expensive provisions, sometimes impossible of fulfilment.

Second—That the engineer does not always familiarize himself with the facilities and standards of the manufacturer, and thus sometimes calls for special designs which can only be made, if at all, at greatly increased expense, whereas standard apparatus would frequently answer the purpose equally well.

Third—That if the manufacturer is required to guarantee results, he should not be hampered as to details of design or construction. In other words, the consulting engineer should not tell the manufacturer how he should build his machine, but simply hold him responsible for results.

To these it may be answered, that no harm can be done by full and free consultations between the manufacturer and the engineer. They have a common object in view, namely, the securing of the best results. It is natural that the engineer should reserve unto himself a due degree of dignity, but he should not let this characteristic stand in the way of the best service in the interest of his clients.

The demand for special machinery, however, presents greater difficulties. It should be remembered that electrical developments have been so rapid in recent years—and with them the construction of special steam engines and appliances—that a large percentage of the work has necessarily been special. Furthermore, this condition must continue, for the reason that the methods of generating and distributing electricity on a large scale, over wide areas, for endless varieties of purposes, have by no means reached uniformity of practice or system, and are not likely to very soon. The necessity for special machinery will, therefore, remain with us indefinitely and will continue to cover a large percentage of our work. We must not lose sight of the fact that to attempt to carry the idea of standards too far will surely result in hindering improvements and stifling progress.

I do not desire to be understood, of course, as decrying the use of standard apparatus for that large and increasing percentage of cases for which it is eminently well adapted. The manufacturers deserve great credit for reducing their machines for different classes of service to standards, and the engineering profession is under many obligations to them for doing so in so thorough and excellent a manner. The reduced cost of standard apparatus—the fact that in using it one follows precedent, that repairs can be more quickly and more cheaply obtained, and that when secured, the different parts are actually interchangeable and will fit, and the further fact that standard machines can usually be secured in less time, being frequently carried in stock—all these are points of tangible advantage which no conscientious engineer can afford to overlook. Standard apparatus, however, is only possible when permanency of type and a reasonably constant demand in large quantities is assured. While it will frequently pay the engineer to modify his plans so as to use standard apparatus, there is a point beyond which he cannot go. In such cases he must use special apparatus more closely adapted to his particular needs. All these points must be given the most thorough consideration, and before requiring special work the engineer must satisfy himself, beyond doubt, that his principal's needs can better be supplied in this manner, even at the increased cost, and in spite of the greater risks which always accompany the use of new and untried apparatus.

The contention that when a manufacturer guarantees results he should be allowed to design and build the machine in his own way may be granted, in so far as the guarantee can be made to cover every possible valuable feature. When a reasonable number of manufacturers, however, have adopted certain designs and processes of unquestioned superiority, and where these have an important bearing on the life and reliability of the machine, its freedom from annoying interruptions, and which reduce or avoid the necessity for close and continued attention, is it

* Paper presented at the Niagara Falls meeting (June, 1898,) of the American Society of Mechanical Engineers.

proper to write the specifications so as to limit competition to machines of this advanced type?

Contractors frequently object to specifications which include a deduction for delay in completing the work, but which allow no extra compensation for finishing the work earlier than the date specified. When it is possible for the purchaser to make use of the plant at the earlier date, this criticism is well founded. It is usually the case, however, that the earlier completion in no way benefits the owner, because other equally important contracts may not be finished, or because the dates of leases or contracts for service from the plant cannot be brought forward. The delay of any one contractor, however, might readily cause the purchaser serious loss.

Another objection made by the manufacturer—and one which is not wholly without justification—is the unnecessarily exacting requirements of some specifications, and the annoyance to which they are subjected by the engineers. It is unfortunately true that our profession has been no more fortunate than others in keeping out of its ranks the incompetent and the unscrupulous. These men have brought disgrace upon the profession, and the objection of the manufacturers to being handicapped by them is well founded. There is, however, no reason now why the purchaser—even though absolutely unfamiliar with work in this field—should make a mistake in selecting an engineer, as a very little investigation will enable him to ascertain the character, ability and experience of the man under consideration.

The engineer stands between the purchaser and the contractor, and while he may sometimes insist upon his client's rights to an extent which may appear unjust, he nevertheless recognizes the purchaser's obligations as well, and will see that his end of the contract is equally well maintained. In this way unreasonable requirements may be avoided, prompt payments secured, and the acceptance and settlement made at the proper time and along reasonable lines.

Unfortunately there are some manufacturers who think the consulting engineer unnecessary, and that the business could be better transacted directly between the manufacturer and purchaser. This would be true if the purchaser were always competent to judge of the relative merits of the different systems of apparatus. Unfortunately the agent of the manufacturer cannot always be trusted implicitly as to recommendations, for two reasons: First, he has not the time to give to the detailed study of the problem which the consulting engineer must give in order to make a proper selection; second, his recommendations are too often biased by a desire to sell standard apparatus, or some specialty of his own, which could be used for the work, although less advantageously than something else.

It is here that the engineer serves his client best, in seeing that the proper apparatus is selected, and that it is bought at reasonable figures. The days when the salesman with the glibbest tongue did the most business are fortunately passing away, and the small manufacturer has as good a show to do business with the engineer as one of longer standing, providing his apparatus is clearly the best for the work.

The engineer compares machines on as nearly the same basis as possible. So far as the character of the machine will permit, he requires all proposals to be on the same apparatus. When this is impracticable he specifies capacities, results, and general type or construction, leaving the manufacturers to vary the details in accordance with their own designs and practice. Such proposals, however, should be accompanied by ample data, so that the points of agreement and difference may be clearly brought out. With these data before him the engineer is prepared to analyze the bids, and to make a recommendation based upon merit alone, irrespective of the name-plate which may be attached to the machine.

It is not meant by this that no weight whatever is to be given to long experience and established reputation, as there are many details which cannot be inquired into, and must be left to the manufacturer's judgment. No conscientious engineer, however, will let the mere reputation of a manufacturer carry undue weight.

Early in my own practice I learned that while elaborate and detailed specifications, embodying all sorts of unusual and peculiar requirements, might impress the non-technical reader, and might even gratify the purchaser, they invariably limited competition, and led to excessive prices and annoying delays, and that by purchasing machines as nearly standard as possible, and by modifying the contract to a reasonable extent, to suit the manufacturer in unimportant details, much better terms could be made, without increased trouble to either the purchaser or the engineer.

The contract forms submitted by many manufacturing companies are unfair to the purchaser, in that they are wholly one-sided, and are intended to protect the seller in every way possible, while the rights of the purchaser are given but little consideration. Such contract forms are far too common, and for the credit of the profession it is hoped that these may be modified and brought to a more equitable basis.

The ordinary proposals submitted by many companies are equally unfair. Perhaps the most flagrant instance of this is the statement in many bids that they are not effective until approved by an executive officer. Such proposals are not worth the paper they are written on, and should not be considered for a moment by any self-respecting engineer, as they in no way bind the bidders, and their acceptance simply ties up the purchaser. Instances are not lacking where manufacturers have taken advantage of this clause to repudiate bids apparently made in good faith. So common is this practice that it has become necessary to incorporate a clause in the "Notice to Bidders," to the effect that proposals which are not made in good faith will not be considered.

Another unfortunate practice is that which many manufacturers have of asking the return of their proposals and accompanying data as soon as the award is made. These papers are necessary to the purchaser and the engineer, to make a complete record of the transaction, and should be retained by them.

On the other hand, it must be admitted that some engineers' specifications are unfair to the manufacturer. The points on which these complaints are based have been given due consideration, and in my own practice have led to the following rules:

First—When it is desired to permit the bidder some elasticity, and not to require him to adhere rigidly to the specifications, the "Notice to Bidders" contains a clause reserving the right to waive informalities.

Second—The engineer is made the arbitrator of all disputes, but appeal is always permitted to a referee or referees. If the contractor thinks he is being treated unfairly he may avail himself of this privilege.

Third—A clause is frequently inserted to the effect that where a special make or type of apparatus is mentioned in the specifications, it is not intended to mean the exclusion of all others, but simply as establishing a standard of excellence. The bidder may substitute other apparatus in his proposal, the engineer reserving the right to judge as to whether the article offered is equivalent to that specified.

Fourth—Where the work is such that it is impossible to go into details very fully, and where the apparatus is of such a character that different builders offer different types of construction, which accomplish substantially the same results; or where it is desired to secure the benefit of the most recent improvements, a general clause like the following is sometimes inserted:

"While it is believed that the following specifications properly cover the needs of the purchaser at this time, they are not necessarily final. Bidders are invited to submit alternative propositions embodying any other types of apparatus, or other details of construction, which in their judgment may seem as well, or better, adapted to the purchaser's needs."

It is to be hoped that this presentation of the matter may result in a better understanding among all parties interested, as to mutual obligations and responsibilities. I believe I may say for the engineers that they will meet the manufacturers fully half way in an effort to reach a more satisfactory basis of co-operation, and to bring about a higher standard of design, workmanship and efficiency, and a more uniform and equitable definition of contract relations.

ALTERNATING CURRENT TRANSFORMERS—FROM THE STATION MANAGER'S VIEWPOINT.*

BY W. F. WHITE.

In the early days of alternating central station development many a sale of alternating central station equipment was lost to direct current competitors by the facts, figures and fancies which the salesman of direct current apparatus was able to advance concerning the wastefulness of energy, the expense of maintenance, and the danger to life which purchasers must accept as inseparably wedded to any transformer system.

Notwithstanding that the danger to life was unfortunately made much of, and the facts grossly misrepresented, still the correctness of many of those arguments, in the light of present knowledge, stand up remarkably well under the scrutiny of qualitative analysis. And it is even more remarkable, in view of the natural tendency to exaggerate induced by zeal to make sales, how little, if any, were the facts of these evils overdrawn or magnified. Quantitative analysis in fact proves that most figures then given to show the amount of transformer "leakages" were understated. On the part of salesmen this was undoubtedly more a mistake of the head than of the heart, for while some few of them knew the results of some isolated tests of some particular size of one type or manufacture of transformer, no one, whether salesman, engineer and designer, or manufacturer, had any knowledge or conception of the cumulative effect of transformer losses on the station output. Such little knowledge as had then been acquired related more to the transformer efficiency under certain percentages of rated load than to all-day efficiency, or the 24-hour ratio of energy output to energy absorbed under average conditions.

Little if anything was known of transformer core losses, and the effect of power factor on station and line capacities had not had consideration. As long ago as 1892 the writer, in making a careful examination into the operations of one of the then largest alternating stations in this country, made the discovery that with a net meter rate to consumers of about 20 cents per 1,000 watt hours, the income per KW. hour output at the switchboard was only about six cents, showing an average loss from station switchboard to consumer's meter of about 70 per cent.

Current was supplied, in accordance with the then universal practice, through one or more transformers for each customer. In two or three cases for

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large installations as many as 18 or 20 transformers were erected for a single customer, no transformer of more than 75 lights capacity being used, the transformer primaries connected in multiple, but the secondaries feeding entirely distinct and separate circuits.

Of each 1,000 watt-hours output at the switchboard it was estimated that approximately 300 watt-hours were delivered through the customer's secondary meter, 600 watt-hours were accounted for by transformer core losses, leaving 100 watt-hours to be accounted for by transmission and other losses.

A statement of these conclusions to a well-known manufacturer, who supplied the wattmeters and many of the transformers, elicited the opinion that either the primary meters registered too fast or the secondary meters too slow.

A meter expert from the factory accordingly spent several weeks in testing all primary and secondary meters, found them correct, and proved that the apparent discrepancy was not due to the meter end of the plant equipment. With the writer's recommendation that a three-wire secondary network be erected, using 100-volt lamps, and fed through large transformers at frequent centers of distribution, the matter was dropped; but there is no doubt that the proportion of the output attributed to transformer losses was approximately correct.

Since that time it has been the writer's good fortune to be in touch with a considerable number of alternating plants, giving him knowledge of their operating results, and he does not hesitate to assert that very few plants exist, giving continuous service, using separate transformers for individual customers and charging from 12 to 20 cents per 1,000 watt-hours, secondary meter measurement, whose income per KW. hour output at the switchboard exceeds from four cents to seven cents. In other words, the transmission, transforming and distribution losses are commonly as much as 200 per cent. of the customers' demand, as shown by the customers' meters. This does not mean operating expenses three times as great as if all these losses were eliminated, but it does mean that large expenditures are made for fuel and feed water for the keeping warm of numerous transformers operating about twenty hours per day with open secondaries. And great numbers of small transformers also mean great variations of secondary voltage, large bills for lamp renewals, unsatisfactory service, and a reduced number of lamps which can be served at any instant from a given generator capacity. To show the benefits to be derived by using a secondary network, fed by large transformers working in multiple, but located one at each feeding point or local center of distribution, as compared with the use of small transformers, one or more to a customer, the writer presents some results accomplished by an existing plant in remodeling its transformer system in accordance with these ideas.

January 1, 1895, this plant was serving 16,702 incandescent lamps (16 CP. equivalent) through 547 transformers of 22,190 lamps rated capacity, each transformer averaging 40.6 lamps capacity and serving 30.6 lamps. The transformer load, with open secondaries, was, as near as could be determined, about 80 amperes at 1,000 volts. In view of the fact that the maximum load never exceeded 50 per cent. of the lamp capacity connected, it was evident that a very considerable reduction could be made both in the number of transformers connected and in their aggregate capacity by the use of a secondary network. The theoretical limit was to reduce the transformer capacity to equal the maximum load, which would lower the capacity connected from 22,190 lamps to about 7,000 lamps, a reduction of about 64 per cent. This limit was evidently impossible of attainment because of the large number of isolated installations, especially in the residence districts, requiring individual transformers, which of necessity must generally be of capacity equal to several times the average load. A system of three-wire secondary networks was laid out, and estimates made showing a possible reduction of almost 80 per cent. in the number and of about 50 per cent. in the lamp capacity of transformers connected. A large number of tests of core losses of all sizes of transformers in service was then made for estimating the total core losses for the plant and for comparisons with the estimated core losses of the large transformers to be erected in replacing the old.

An illustration of one or two of these comparisons may be of interest. One installation of approximately 700 lamps was fed through a large bank of small transformers having an aggregate core loss of 4,440 watts, which could be replaced by two transformers having a combined estimated core loss of 310 watts. On the basis of the number of watt-hours per pound of coal then being produced by the plant, not taking into account any line losses, this example shows the following results :

4,400 watts, 38,894,400 watt-hours per year, requires 190.6 tons of coal.

310 watts, 2,715,600 watt-hours per year, requires 8.4 tons of coal.

Annual saving, 36,178,800 watt-hours, 182.2 tons of coal.

The annual income from this installation was about $2,100 at 12 cents per 1,000 watt-hours. With a secondary output of about 17,800,000 watt-hours, and transformer core loss of about 38,894,400 watt-hours, the income per KW. hour output at the switchboard for this installation was evidently less than four cents, and the core losses were more than double the total secondary output.

In another case, one section of the city, comprising ten city blocks, was fed by one dynamo and circuit through 71 transformers, having an aggregate rated capacity of 4,482 lights and aggregate core losses of 10,402 watts (estimated), or 91,121,520 watt-hours per year.

To replace these transformers a three-wire secondary network was erected, supplying all customers, and fed by five 400-light transformers, located at as many feeding points or local centers of distribution. Each transformer was provided with primary and secondary switches, by means of which each night all transformers were thrown into service from dusk until midnight, at which latter hour four transformers were cut absolutely out of circuit. On a yearly average five transformers were in circuit about six hours per day and one transformer the remaining 18 hours per day. The combined core losses of the five were about 1,250 watts, and for the hours in service aggregated about 4,380,000 watt-hours per year. Some results of the above changes on this one circuit therefore were as follows :

Number of transformers.	Lights capacity.	Total core losses. Watts.	Total annual core losses. Watt hours	Equivalent tons coal.
71	4,482	10,402	91,121,520	446.7
5	2,000	1,250	4,380,000	21.5
Saving......	2,482	9,152	86,741,520	425 2

A reduction of over 95 per cent. in core losses and a saving for one year in cost of fuel alone of $815.40 were effected for this one circuit. These examples were extremes, because the lighting covered by them was concentrated, and because in most residence and outlying business districts few changes in the number and capacity of transformers could be made. The results shown by the last example were therefore much above the average for the whole plant, but serve to show the possibilities of such changes and the methods pursued in this case.

Some results for the plant as a whole may therefore be fairly indicative of what other average plants operating under similar conditions may accomplish in the same direction, and were as follows :

Time.	Lamps connected.	Transformers connected.	Total capacity.	Average lights capacity.	Average lights served.
Jan. 1, 1895.	16,702	547	22,190	40.6	30.6
" 1, 1896.	19,282	201	13,865	69.	90.1
" 1, 1897.	20,262	152	13 498	88.8	133 3
" 1, 1898.	23,643	141	14,916	106.	167.7

Year.	Income.	Switchboard output KW. hours.	Income per KW. hour output.	Increase of income per KW. hour output.
1894	$59,012.71	928,400	$.0635	....
1895	54.231.67	791,752	.0681	7.7 per cent.
1896	51,115.29	551,064	.0933	16.9 per cent.
1897	56,317.42	508,070	.1108	71.5 per cent.

Year.	Actual KW. hrs. output.	Estimated KW. hours output — basis 1894 conditions.	Estimated KW. hours saved by change.	Estimated saving in coal—1894 basis.	
				Tons.	Cost.
1894	928,400	......	......	......	......
1895	791,752	851 042	63,290	310.2	$670.91
1896	551,064	809,689	258,625	1,267.8	2,641.42
1897	508,070	886,888	378,818	1,856.9	4,015.13

It must be borne in mind that the number of 16 CP. equivalents connected January 1, 1895, was 16,702, and increased by January 1, 1898, to 23,643, or more than 41.5 per cent. The savings estimated in last table are based on the conditions at the beginning of this period, i. e., the same number of transformers and the same transformer capacity. But if the same conditions had obtained throughout, an increase of 41.5 per cent., or 226 transformers, of 9,208 lights capacity, would have been added to supply the new lights connected. And while only a part of the core losses of the transformers in service January 1, 1895, was saved by the change, the entire losses of the 227 transformers, which would have been required by increased business, were saved. It is therefore perfectly safe to add 50 per cent. to the savings shown in the last table, in estimating actual benefits. From reduced core losses alone, therefore, there is an annual saving of approximately $6,000.

In core losses alone, the savings already effected have more than paid all costs of the entire change of lamps, meters and transformers (for because of a simultaneous change from 52 volts to 106 volts, secondary, all lamps and meters also had to be changed), and of the erection of secondary network; and the annual saving of $6,000 is equal to 6 per cent. interest on $100,000, secured without one dollar invested.

To be certain that the saving of fuel was in proportion to the reduction in KW. hours output, as estimated, the plant efficiency under the changed conditions must be known. It is therefore pleasing to note that, using coal from the same mine most of the time, the watt hours output per pound of coal actually increased for 1896 by 3.8 per cent., and for 1897 by 5.9 per cent. over 1895, so that the saving in fuel was at least not less than in proportion to the saving in KW. hours output.

Some incidental advantages of the change may be mentioned :

First—Under the old plan, the 6,941 lights added would have required about 9,200 lights additional transformer capacity, of 40 lights average size, of $1 per light average cost, giving an investment saving of $9,200.

Second—The transformer load, with opened secondaries of 80 amperes, was reduced by the fall of 1897 to about 30 amperes, notwithstanding an increase of about 25 per cent. in the number of lights connected. A saving of 50 amperes at 1,000 volts represents a capacity to serve, without additional

station or line equipment, approximately 1,000 16 CP. equivalents, all burning at one time, or fully 2,000 16 CP. equivalents connected.

Third—Formerly as many as a dozen transformers were frequently burned out in a single thunderstorm. Ten per cent. of the transformers connected would be a conservative estimate of the number burned out each year from various causes. Of the new transformers connected during the past three years only one has failed from any cause, and that one was defective and burned out under light load almost immediately upon being put in service. Transformer repair costs are therefore practically eliminated.

Fourth—Incandescent lamp renewals have been greatly reduced. Using lamps from the same factory of the same efficiency and bought at the same price per lamp, the cost (estimated) of renewals per KW. hour consumed by the lamps has been reduced from \$.0081 in 1895 to \$.0057 in 1897, a reduction of 29.6 per cent. This saving represents the advantage of regulating the secondary voltage by pressure wires connected to the secondary network, as compared with the former method of regulating the primary voltage by station transformers.

Fifth—The principal remaining incidental advantage is the uniformity of voltage, bringing uniformity in quality of service and the consequent satisfaction of customers, the value of which cannot be estimated in dollars or percentages. These are some actual results, and such as any plant operating under similar conditions can achieve at small expense, if the changes are well planned, and the replaced apparatus sold to the best advantage.

In this connection, attention must be called to one other fact, which is that central stations using separate transformers for individual customers have the great majority of their transformers working on open secondaries probably 80 per cent. of the time. The best transformers have a power factor of about 50 with open secondaries, and of fully 99.9 with almost any load they carry in practice. It is therefore perfectly credible, and the writer has demonstrated it to be so by many actual tests on various plants, that the average power factor of plants operating under above specified conditions is approximately 65.

It scarcely needs demonstration that if, instead, a secondary network is used, and only such transformers allowed to remain in circuit at periods of light load as are required to advantageously carry such load, the average power factor will be approximately 100. The volt-ampere hours therefore, calculated from the station voltmeter and ammeter readings, give approximately the watt-hours output. But almost all existing plants use separate transformers for individual customers, and the great majority of them do not have primary wattmeters on their switchboards, and do calculate their volt-ampere-hours output as equivalent to watt hours, getting results about 50 per cent. in excess of the facts. They therefore are able, apparently, to show 50 per cent. more watt-hours per pound of coal and 33⅓ per cent. less expense per KW. hour output than another station operating under the same conditions and fully equalling theirs in actual performance but which accepts the primary meter readings as the basis of estimate.

As a matter of fact, the usual disparity is greater than the percentages given, because most station managers in erecting primary switchboard meters follow their æsthetic inclinations, and use ornamental glass covers which are particularly susceptible to the admission of dust and grit, with the result that the meters rapidly slow down. It is highly probable therefore that in some stations the volt-ampere-hour record would show twice the number of apparent watt-hours per pound of coal, and one-half the expense per apparent KW. hour output that would be shown by the record of the primary meter already erected on the switchboard, which tends only to show the worthlessness of data from different plants for purposes of comparison, unless the local conditions are known in each case.

This digression is permissible, we hope, because the average power factor, so far as we know, has never been taken into account, and because for that reason much misleading alternating central station data is in circulation.

Purchasers and users of transformers should insist that transformers meet certain requirements, or be rejected, and some of these requirements will be stated.

Where transformers are used for feeding networks, the secondaries in multiple, small core losses are of much greater importance than close regulation, and should be kept at the lowest practicable point. The regulation will be cared for by treating the transformer and feeder drop together, through the use of secondary pressure wires.

Where the transformers are entirely independent, feeding separate secondaries, close regulation must be had and the core losses made as low as the adopted regulation will permit. With constant full load the temperature must not rise to a high point, and should not exceed 50° centigrade above the surrounding air. This is important not only because of the increased life of transformer insulation through low temperatures, but also, and possibly to a greater degree, because magnetic fatigue is a certain follower of high core temperatures. If therefore the core losses might be increased 50 per cent. or possibly 100 per cent. through high temperatures, the cost of these core losses, as shown in case of the plant above, makes argument unnecessary as to the desirability of having transformers run cool.

The transformer case should be filled with oil, because of its insulating qualities, its exclusion of air and because of its assistance in maintaining the low temperature desired.

The insulation resistance between the primary and secondary windings should be able to stand up under not less than 10,000 volts, alternating, difference of potential for transformers having 1,000-volt or 2,000-volt primaries, and the writer would strongly urge a 15,000-volt alternating test. If both the primary and secondary windings are on the core, the same insulation resistance should be required between either winding and the core as between the two windings. The use of grounded shields placed between the primary and the secondary windings, the grounding of the shell or core, the grounding of the secondaries, the placing in each customer's service connections of any device to automatically open the circuit of such customer in case of an unusual difference of potential, are all practices that are opposed as expensive, as liable to cause, more than to prevent trouble, as complicating existing practice, and as wholly unnecessary.

Proper insulation is sufficient protection against the damages sought to be avoided. Station managers as earnestly desire complete safety for life and property as the Underwriters' Association, but vigorously oppose the introduction of any unnecessary devices that are expensive to install and to maintain. That Association, in seeking protection for the secondaries, should do so through sufficient transformer insulation and low temperatures. Both of these requirements mean increased cost of production and higher selling prices, but as the consequent increased economy makes the increased cost a profitable investment, no reasonable manager will object. In this way the ends sought will be best attained, and the interests of all parties duly safeguarded.

The General Electric Company owed on July 1, 1898, \$1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

WHAT MARCONI HAS SO FAR ACCOMPLISHED.

The Dublin *Mail* publishes the following account of an interview of one of its representatives with Signor Marconi. The latter said:

"We have an installation that sends messages a distance of 14½ miles across salt water between Bournemouth and Alum Bay, Isle of Wight. This was done to prove that weather temperature and climate had no power to affect the working of my system. It proved incidentally that the invention can be worked by any capable telegraphist without any special training whatever. It was also proved that any vessel coming within 12 miles of either of the two stations, which had on board an instrument similar to the ones used at the stations, could communicate with the latter. A small tug of ours communicated with the shore at a distance of 18 miles, although the weather was extremely unfavorable. I found that it is easier to communicate between ship and ship or between ship and shore than it is to exchange messages between stations on land. When last year the Italian Government kindly placed at my disposal two ironclads for purposes of experiment, I established communication at a distance of 12 miles with the shore and between the ships themselves. The invention is now being used in the Italian Navy. The size of the vessel upon which the invention is used does not affect its working, the best results having been obtained on the small tugboat referred to off the Isle of Wight. The sea was then very rough, and we had at times 2 ft. of water in the cabin, all the instruments being drenched with it, but without impairing their usefulness. On that occasion communication was established with the island 18 miles away. Captain Kennedy, R.E., who was on board, stated these results in a public lecture delivered at Whitehall, and expressed his complete satisfaction at the success of the experiments. In war the invention is of the greatest use to torpedo boats or destroyers, which, with the apparatus on board, would be able to communicate at a considerable distance with the battleships of the squadron to which they were attached. This has been proved by experiments made in the navy by one of the great Powers. In the mercantile marine the invention is of even more practical utility than on board a man-of-war. Provided lightships and lighthouses are fitted with my apparatus, ships in foggy weather can be warned of danger from the lighthouse or lightship when the flashlight or the sound of a bell could not reach the vessel. Ships could also communicate with each other and interchange a warning. The warning apparatus in a lighthouse can be so set as to sound the alarm to any ship coming within a radius of 10 miles, and the latter will know from the kind of signal received what particular lighthouse it is that has signalled. This is done by means of a reflector moved around the receiving instrument on the principle of a dark lantern, through which only the electric rays penetrate. I have been informed by an evening newspaper of the 20th inst. that when a party from the House of Commons visited the dockyard at Portsmouth they found officers and men of the Royal Navy being instructed in the working of wireless telegraphy, which I have frequently discussed with British officers of both the army and navy."

New Use of Liquefied Air.

Prof. Charles E. Tripler, the discoverer of a process of making liquefied air, in a recent issue of the Philadelphia *Times* says regarding the possibilities of it when used in warfare:

"Among them are the immediate application to the firing of projectiles, the explosion of shells and torpedoes, the driving of vessels at greater speed with less consumption of coal, the cooling of the turrets in action from the torrid heat to a moderate temperature, thus enabling the men to handle the guns with better efficiency and adding to their en-

durance, the cooling of the stoke-holes and all parts of a warship.

"The benefits of the foregoing are self-evident. It is now simply a question of mechanical application. The power exists and is ready to be used; it only remains to be determined how it can best be applied. It is a power evidently exceeding any hitherto employed. Its limits cannot yet be defined, from a gentle, cooling breeze to the power necessary to drive the largest vessel or hurl the heaviest projectile. This is no guesswork nor mere speculation. These are fundamental facts that I have established:

"First—Liquid air can be manufactured easily, cheaply and in large quantities.

"Second—A cylinder can be charged with liquid air under conditions which give an expansive force equal to or greater than that of gunpowder, or an explosive exceeding gun cotton or dynamite.

"Third—It cannot be exploded except by a spark (produced in any desired manner) and being unaffected by concussion, it is perfectly safe to be handled and can generate any pressure desired at will.

"Fourth—Liquid air can be produced anywhere and at any time. Any ship could carry and operate the mechanism for its production.

"Fifth—Liquid air is from 20 to 100 times as powerful as steam, and it can be applied as easily as steam to drive the engines of a ship.

"These, I repeat, are not guesses, but established facts, and inevitable corollaries from such facts."

SOME NOTES ON THE ELECTRO-DEPOSITION OF PLATINUM.*

BY SHERARD COWPER-COLES.

The resistance of platinum to the action of corrosive acids renders it invaluable for the coating of chemical and electrical apparatus. Considerable difficulties have been experienced in obtaining a satisfactory deposit of platinum, the thickness of the coating being very limited. Smee was one of the first to study the conditions under which good metallic deposits of platinum could be obtained. He obtained the best results with a solution composed of nitro-muriate of platinum, to which sufficient soda was added to render it neutral. He used as an anode a fine platinum wire, oxygen gas being given off from the platinum wire, and no gas evolved at the cathode. Smee designated obtaining bright deposits of platinum as platinating, in contradiction of platinizing. To platinize metals, according to Smee, a strong current is used to decompose the water and drive off hydrogen at the cathode, so as to produce platinum sponge or black. Roseleur has also given considerable attention to the electro-deposition of platinum; he claims to have obtained thick deposits of platinum from a solution composed of 10 parts of platinum converted into chloride dissolved in 100 parts of distilled water.

If any cloudiness appeared in the solution when the chloride was dissolved in the water (due to overheating in the last stage of evaporation), the solution was passed through a filter. One hundred parts of phosphate of ammonia (crystallized) were then dissolved in 500 parts of distilled water, and the solution added to the platinum liquid with brisk stirring, when a copious precipitate formed. To this was next added a solution of phosphate of soda, consisting of phosphate of soda 500 parts, distilled water 1,000 parts. The above mixture was boiled until the smell of ammonia ceased to be apparent, and the solution, at first alkaline, reddened blue litmus paper. When the yellow solution became colorless, it was ready for use; the solution is used hot, with an EMF. of 7 to 8 volts; Roseleur recommends it for depositing platinum on brass, copper and german-silver. As the platinum anode is not dissolved, fresh additions of chloride must be constantly added. The writer has been unable to obtain thick deposits from this solution; the platinum, after it has obtained a certain thickness has a great tendency to exfoliate. For a short time a process was carried on by the Platinum Plating Company, Limited, which was practically identical to the above, with the exception that a small addition was made of chloride of sodium; this solution gives no better results than Roseleur's. Boettger's solution for depositing platinum consists of the double chloride of platinum and ammonia dissolved in water to which a few drops of liquid ammonia are added. The solution is worked warm.

Another solution of Boettger's consists of the double chloride of ammonia dissolved in 8 parts of salammoniac, and another of the double chloride of platinum and ammonia freshly precipitated at a boiling temperature, dissolved in a concentrated solution of neutral citrate of sodium. The resulting liquid is a deep orange color with a feeble acid reaction, and should be worked cold with a current density of about 3 amperes per square foot, and an EMF. at the terminals of the bath of 7.5 volts. If the solution contains about 1½ ozs. of platinum to the gallon of solution, excellent bright deposits are obtained.

Gore, in his book on "Electro-Metallurgy," refers to a solution of chloride of platinum dissolved in one of cyanide of potassium, the proportions of metal being kept at about 1 oz. to the gallon; the bath being used warm. Jewreinoff affirms that the platinum anode is dissolved freely in a solution composed by dissolving 10 parts of metallic platinum which has been converted into chloride in 10 parts of caustic potash in water, the yellow precipitate being dissolved by the addition of 20 parts of oxalic acid in aqueous solution with the aid of heat. To this solution is added 30 parts of caustic potash solution. The solution is strongly alkaline. Jewreinoff has also used another bath for the deposition of platinum in which he converts three parts of platinum into chloride and dissolves this in 300 parts of distilled water, to which is added 25 per cent. of sulphuric acid. He also recommends the use of platinum anodes in this bath.

* From the *Electrical Review*, London.

A New Electric Ship Signal.

An interesting application of the principle of the rotating magnetic field to signaling apparatus, says the *Electrician*, London, is described in some of our Continental contemporaries. This signal system, due to Dr. L. Weber, is intended to replace the step-by-step devices now used for many purposes, but especially for the purpose of signaling between bridge or pilot-house to engine-room on ships. Similar dials are used at the ends of the line in these devices, the signal being given by moving an index lever over the dial at the sending station and causing a corresponding movement of an index hand over the revolving dial. In Dr. Weber's device the sending instrument consists of an endless resistance helix arranged in a circular form on the dial and wound on a resistance frame in the manner of a Gramme winding. This resistance is tapped at three equidistant points by three conductors which are led to the receiving dial. Here they are connected in the three-phase star fashion with three radially disposed magnets controlling a small two-pole armature of soft iron attached to an indicating hand. The current energizing this receiving instrument is furnished and suitably distributed by the sending instrument already referred to by an index lever pivoted in the center of the resistance helix and furnished at its ends with contact pieces touching on the opposite ends of the diameter of the resistance—these contact pieces being terminals of an electrical source, the current from which is differently distributed in the three circuits, and therefore in the magnets of the receiver with every different position of the transmitter lever.

Rapid Transit in London.

While New York is struggling with rapid transit problems, in which it is hard to say whether the engineering, the financial or the political elements constitute the greatest obstacles to progress, London seems to be going ahead and providing its millions with facilities for rapid communication on novel and effective principles. Having outgrown the old smoky and gloomy underground road, the British metropolis is now being rapidly provided with a system of lines mainly based upon the work of the late Mr. Greathead, the engineer and designer of the City & South London Railway, the first of the deep-level, underground electric roads. A description of that enterprise, which connects the north and south portions of London, is unnecessary. Its success, however, has led to the planning of a number of other roads of the same general character, including the Central London Railway, now approaching completion, which, starting from the Mansion House, will run a number of miles through the residential districts at the west. The Waterloo & City Railway is another of them, and has just been completed. It leads from the Mansion House—that is to say, the immediate neighborhood of the Bank of England and the London Stock Exchange—to the Waterloo station of the London & Southwestern Railway, on the south side of the Thames. In this, as in the other tubular electric roads built or in process of building in London, American inventiveness in the field of propulsion by electric power has been freely used, and it is to be noted that in the case of the Waterloo road the very cars employed are of American manufacture, having been built at one of our leading works and representing in their plan American rather than English ideas.

The Waterloo road is a short line. The distance between its termini is only 1½ miles, but it traverses some of the busiest and most substantially built portions of London. The line consists of two tubes, one for the up and the other for the down line, which at the furthest point from the surface will be some sixty feet underground. It is unique in several features. One of them is that there is no intermediate station between its two termini, and the other is that it at no point rises to the surface, as is the case with its prototype, the City & South London, or original "Greathead system" line. While primarily designed for the benefit of the suburban and general traffic of the London & Southwestern Railway, the new line will give rapid communication between two crowded portions of London. The fare locally is to be 2 pence, or 4 cents, and the trip will be made in five minutes, the trains running on five-minute headway, or more frequently if traffic makes this necessary. Altogether this interesting enterprise, of which the formal opening is soon to take place, furnishes a number of important suggestions for American cities and for New York in particular. —*Bradstreet's, July 16.*

The Electric Telescope.

The latest apparatus for telegraphing images to a distance, says the *Electrical Engineer*, London, is the idea of M. Dussand, the inventor of the microphonograph. The image is received in a camera, passed through a rotating shutter pierced with small openings arranged in a spiral, and falls upon a selenium plate, through which is passed an electric current traversing the primary circuit of an induction coil. The apertures of the shutter bring the light of successive parts of the image to the selenium, setting up currents in the secondary circuit of the coil that vary in strength with the intensity of light, according to a well-known law.

The varying currents pass to the receiving instrument, where a very sensitive telephone diaphragm is placed more or less in front of a fixed plate, more or less weakening a beam of light that passes a shutter exactly like that of the transmitter, and moved

in unison with it, and is thrown upon a screen by a system of lenses. The light reaching the screen has the same intensity as the corresponding part of the image. The result is, so the theorists say, that when both shutters are rotated over the entire image in a tenth of a second, the time visual impressions persist, and the entire image is seen on the screen.

LEGAL NOTES.

In the suit brought at Cincinnati by the Westinghouse Electric & Manufacturing Company against the Triumph Electric Company for infringement of a patented device, United States District Judge Clark decided in favor of the Triumph Company, dismissing the suit and putting the costs on the plaintiff.

The Supreme Court of Missouri has given a decision affirming the legality of the franchise under which the Sutter Conduit Company built its conduits in St. Louis some years ago. The decision allows the Sutter Company to string its wires in the conduits and to connect these wires with the houses along its route. It compels the Board of Public Improvements to issue permits to the company.

A preliminary injunction has been asked by the Thomson-Houston Electric Company in the United States Circuit Court restraining the Walker Company, a New Jersey corporation, and the Union Railway Company of New York from making or using certain electrical devices, said to have been invented by Elihu Thomson, and which are alleged to be infringements of patents held by the Thomson-Houston Company. These patents are on electrical commutators or switches, devices and arresters for electric power, lighting circuits, etc. The complainant charges that the Walker Company manufactures and the Union Railway Company uses these devices in spite of repeated protests, and asks for damages in a suit filed.

The right of an abutting owner to compensation for damage caused by the poles and wires of an electric railway in the street is sustained, Jaynes vs. Omaha Street Railroad Company, Neb., 39 L. R. A. 751, and it is said that it is not necessary for this purpose that the road should be an additional burden upon the easement, as matter of law, under a constitutional provision for compensation in case of property damaged for public use.

The killing of a deaf and dumb boy by an electric car fitted with defective brakes, preventing the motorman from stopping it with proper readiness, is held, in Thompson vs. Salt Lake Rapid Transit Company, Utah, 40 L. R. A. 172, to make the street car company liable for damages even if the boy were negligent.

In the suit of the city of Hoboken, N. J., against the Rutherford Railway Company, Judge Lippincott, on the 13th inst. directed the jury to find a verdict for the city and against the company for $23,000, the amount claimed with interest. Judge Abel I. Smith, on behalf of the company, took a number of exceptions and gave notice of appeal to the Supreme Court. The suit was brought to compel the payment of $20,000 which the company agreed to give for a franchise to run its cars in certain streets in Hoboken, but had failed to pay.

The Supreme Court has reversed the decision of the local court which fined Alex. Dow, manager of the Edison Illuminating Company at Detroit, $5 for refusing a factory inspector access to the machinery department of the establishment, and ordered a new trial. The testimony showed that while the inspector was refused permission to enter the engine room by a certain door, he was told that he might enter by another door. The court says it was the duty of the factory inspector to observe reasonable regulations.

Fire and Police Telegraph Convention.

Extensive preparations for the Annual Convention of the Association of Chiefs and Superintendents of Fire and Police Telegraph and Municipal Telegraph Systems, which is to take place in Elmira, N. Y., on August 9 and 10, have been made by Will Y. Ellett, the president of the organization. Mr. Ellett is in charge of the municipal telegraph and telephone system of Elmira. Mr. Ellett says that the people of Elmira will hospitably entertain the visitors. The wish has been expressed that the superintendents and chiefs bring their wives, and while the Convention is in session the women will be cared for.

The Ohio Electric Light Association.

The annual convention of the Ohio Electric Light Association will be held in Sandusky Thursday and Friday, August 18 and 19. About 200, including delegates and their families, are expected. On Saturday, the 20th, the Warren Electric Company and the Sandusky Gas & Electric Light Company will unite in entertaining the visitors. A boat ride to the islands will probably be arranged for. The West House will be made the headquarters of the convention.

"Steam."

The Babcock & Wilcox Company, New York, have just issued the thirtieth edition of their book "Steam." This book has been for years one of the standard works on water-tube steam boilers and on boiler practice generally. The present edition contains much new matter. It is beautifully printed and illustrated and substantially bound, and is sent free to anyone in any way interested in the generation of steam.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILWAYS.

Berrien Spring, Mich.—The council has granted a franchise giving the proposed electric road from South Bend to Benton Harbor right of way through the corporation.

Bennington, Vt.—The work of laying the rails over the five mile connection between North Bennington, Vt., and Walloomsac, N. Y., on the Bennington and Hoosick Valley Electric Railroad was completed a few days ago. This village and Hoosick Falls are now united by a well equipped road about 16 miles in length, and Bennington is given another outlet to the Fitchburg Railroad.

Biddeford, Me.—Col. Charles H. Prescott has purchased a controlling interest in the Biddeford & Saco Street Railway and will improve the line.

Birmingham, Ala.—The Birmingham Traction Co. has begun operating its Gate City line with electricity; it was formerly a steam dummy line, and was considered something of a nuisance, but has been transformed into one of the best electric lines in the South.

Buffalo, N. Y.—The "Times" says: "The proposed Buffalo, Hamburg & Aurora Electric Railway will be built. U. L. Upson, secretary and general manager of the company, has returned from New York City, where he went in company with President Walter Phelps and Vice-President Adam Benzing to talk over the matter with the stockholders of the road. The contract for the construction of the entire line will probably be signed in a few days."

Cleveland, O.—A fire at the Wilson avenue car houses of the Cleveland Electric Railway Company on the 11th destroyed the building and damaged a number of cars. The total loss was not more than $11,000.

Denver, Col.—The Colfax Electric Railway Company has been granted a franchise by which it secures right of way to Montclair.

Doylestown, Pa.—The Newtown Electric Railway Company has filed notification of its purpose to extend its line to Doylestown. The directors of the company are Thomas P. Chambers, Edward H. Buckman, George C. Worstall, Thaddeus S. Kenderdine, William T. Wright, George C. Blackfan, Ashbel W. Watson and Alexander Chambers.

Elizabeth, N. J.—The Union County board of freeholders have ascertained the cost of widening Westfield avenue from this city to Plainfield, which according to the engineers' estimates will amount to nearly $300,000. Bids for the trolley franchise or right of way over the new road will be advertised for and the freeholders hope to get at least half of the cost of the improvement from the sale of the franchise. Ex-Congressman John Kean has already made an offer of $100,000 for the right to run cars over the road, the length of which is twelve miles.

Franklin, Mass.—The Milford, Franklin, Woonsocket & Attleboro Street Railway Company was organized here recently with Hon. Joseph G. Ray as president and Edgar K. Ray as treasurer. There is probability that construction may begin the coming fall. The intention is to build from the State line to Unionville, Franklin and the Attleboros; and also to run from Central street in Milford to North Bellingham, on the south and west side of Bear hill to Unionville from North Bellingham, where connections will be made with main line.

Hudson, N. Y.—The Hudson Street Railway Company intends to extend its line to Claverack and Philmont and at the latter place connect the county seat with the Harlem Railroad. It is understood that a New York syndicate has purchased the road as part of an electrical scheme of large proportions. The projectors of the enterprise intend to harness the waterfalls of Jansen Kill and by means of immense generators produce electricity for the operation of the railway, for manufacturing and other purposes. It is expected that from 2,500 to 3,000 horse power can be developed. The company is already incorporated under the laws of the State of New York as the Jansen Kill Power Company.

Lockport, N. Y.—The Lockport & Buffalo Electric Railway Company has been granted permission to lay a set of connecting tracks on West Avenue and Transit street between those formerly known as the Erie line and local street electric road and operate thereon. The company will have to take up the bond of the former Lock City electric road. The franchise granted is for forty-seven years, it being the remainder of the one granted the Lock City.

Plainfield, N. J.—The work on the extensions of the Brunswick Traction Company between Dunellen and Bound Brook are being pushed rapidly with large gangs of workmen, and it is expected that the road between those two places will be in operation by August 1. Already the line between Bound Brook and Somerville is in operation. When the tracks are laid through Dunellen they will connect with the line of the Plainfield Street Railway Company, which will give Plainfield trolley connections with New Market, Lincoln, Bound Brook, Finderne, Somerville, Raritan, New Brunswick, Franklin Park and Metuchen.

Redlands, Cal.—Ex-postmaster J. H. Boyd of San Bernardino is planning to build an electric railway from that city to Redlands utilizing the abandoned street railway line on D street in San Bernardino.

Rockford, Ill.—A deal has been closed for the consolidation of the City Railway and Rockford Traction companies, to be managed under the name of the Rockford Light & Power Company. John Farson of Chicago owned the Traction plant.

Sandusky, O.—Judge Bentley of Cleveland, representing the Cleveland & Norwalk syndicate that proposes to buy all the electric railway property in Sandusky and to build a road from here to Lorain to connect with one from there to Cleveland, purchased at public sale here on the 9th inst. the plant of the Sandusky electric street railway and is negotiating for the purchase of the other local line, known as the People's. The price paid for the Sandusky company's plant was $60,024, which was two-thirds of its appraised value.

Saratoga, N. Y.—The steam railroad which was operated to the summit of Mount McGregor has been abandoned, and the Saratoga Electric Company proposes to build an electric line over the same route, about nine miles, and over a rough but picturesque country. The trolley line now operated between this city and Saratoga Lake and to the Geysers is said to be paying so well that the company intends soon to build a road to Lake George, a distance of thirty-three miles.

San Francisco, Cal.—The San Francisco & San Mateo Electric Railway Company, the Market Street Railway Company and Oscar T. Weber and associates having filed applications for street railway franchises in the city and suburbs of San Francisco, the board of supervisors advertise a sale of the respective franchises on August 8.

Springfield, O.—It is rumored that a project is on foot to build an electric car line from this city to Yellow Springs, and that Eastern capitalists are considering the matter. There was a similar plan agitated several years ago by other parties, but the scheme fell through

St. Paul, Minn.—It is expected that the new Selby avenue electric line will be in operation by the 1st of August. The work of construction at the hill, including the placing of the new safety device, has been a difficult task. The cost per mile of laying the electric tracks and doing the work incident thereto is estimated at between $25,000 and $30,000.

Washington, D. C.—The "Star" says "it is not likely the Belt railroad will be offered for sale before the 1st of October next. No order of the court directing the sale has as yet been made. It is thought, however, as the transfer of this property, in view of the law lately enacted requiring the equipping of the road with the underground electric system within one year from the ratification by the court of its purchase, involves the outlay of considerable money, it will be necessary to fix such a time for the sale of the road as will enable prospective purchasers to make the necessary financial arrangements."

LIGHTING PLANTS.

Albion, N. Y.—The new local electric light company has a capital stock of $50,000. The directors are Frank A. Dudley, Wallace C. Johnson, a Niagara Falls engineer, Sanford T. Church and Albert Culver of this city. The fifty lights required will not be burning until October 1st, when the Waterport plant will be in operation. A dam 18 feet high is to be built and power will be supplied by 200 horse-power turbine wheels. Two 80-light arc dynamos and two 1,500 light incandescent dynamos will be put in. Until the time mentioned about 25 lights, furnished from steam power, will be in operation.

Beloit, Wis.—The Beloit Electric Light & Power Company has closed a deal whereby it becomes the owner of the Rock River Paper Company's plant, and will convert it into a first-class electric light and power plant. It is the intention of the company to give Beloit one of the most complete light and power plants in the Northwest.

Cincinnati.—The loss by the fire at the Edison Electric Light Company's power station here on the 8th inst. is much less than the first estimate. The value of the building destroyed was about $5,000 and the loss to the machinery and other contents was between $15,000 and $20,000.

East Weymouth, Mass.—John R. Graham and a number of other men have bought the plant and franchise of the Weymouth Electric Light Company in this place.

Fargo, N. D.—The council has passed the ordinance granting an electric light franchise to Gen. Hughes of Bismarck over the mayor's veto.

Fostoria, O.—The directors of the Fostoria Light & Power Company, having received an offer for the purchase of their plant from a Philadelphia company represented by S. R. Bullock of that city, will submit the matter to the stockholders at an early date.

Grand Rapids, Mich.—Mayor Perry has vetoed the municipal lighting plant contracts and new bids will be advertised for.

Lansdale, Pa.—A lot has been purchased by the town and $20,000 appropriated for the erection of an electric plant for street and commercial lighting.

Mercur, Utah.—The transforming station of the Camp Floyd Electric Light Company was struck by lightning recently and was totally destroyed by the resulting fire.

Redlands, Cal.—A transaction is under consideration whereby the San Bernardino Electric Company will come under the control of the Redlands Electric Light & Power Company. This will give the Redlands Electric Light & Power and the Southern California Company control of all lighting between Redlands and Los Angeles.

Scranton, Pa.—A movement is on foot by Scranton and Wilkesbarre capitalists to purchase all the electric light companies between Pittston and Nanticoke. There is every indication that the effort will be successful and that the deal will be consummated at an early date. There are between Pittston and Nanticoke fifteen companies, and it is asserted that all of these have been approached and terms for sale agreed upon in the majority of cases.

Somersworth, Mass.—From present indications it is safe to state that the movement in this city to establish a municipal electric lighting plant will ultimately be defeated. Many arguments for and against the project are daily heard, but the scheme is rapidly losing ground. The city councils were recently informed on the best possible authority that to establish and maintain a municipal plant it would cost the city annually $87.50 per lamp. The city is now paying $80, and it is understood in the near future this figure will be reduced.

Washington, D. C.—Proposals will be received by the District Commissioners until 12 o'clock, July 30, for lighting the public streets, avenues, alleys and roads in the District of Columbia during the year ending June 30, 1899, with gas, naphtha, incandescent and electric arc lamps. Specifications and blank forms of proposals may be obtained at the office of the commissioners in Washington.

Wooster, O.—The Wooster City Lighting Company having declined to concede the reductions asked for by the lighting committee, there is talk of the city putting in its own electric lighting apparatus. The lighting company claims that after large investment and years of hard work they are just getting the plant where it is on a paying basis, and that the town is not large enough and the number of lights required too small to warrant further concessions. The company has a perpetual franchise on the commercial lighting.

MANUFACTURING, ETC.

Ampere, N. J.—A large addition is being built to the Crocker-Wheeler Electric Company's plant in this place. The structure will be of brick and is to cost about $9,000.

Baltimore, Md.—David R. Walker, chief of the Bureau of Electricity of Philadelphia, has been consulted on the question of municipal subways. He says that they have demonstrated to the electrical companies in Philadelphia that the underground system was more economical than the overhead system. He thinks that Baltimore can make a start on the subway system with $1,000,000, and that the system can be built and operated so as to pay for itself, give revenue to the city and not be burdensome to the companies renting space.

Detroit, Mich.—The Western Electric Company of Chicago, preparatory to opening a branch establishment in this city, has filed articles of incorporation with the Secretary of State, placing its capital stock at $1,000,000.

Kingston, Jam.—The new tariff of Jamaica places electrical apparatus and appliances of all kinds for generating, storing, conducting, measuring and converting into power, light, etc., on the free list.

Louisville, Ky.—The stock of James Clark, Jr., & Co., dealers in electrical supplies, was almost totally ruined on the 12th inst. by the burning of the building in which the firm was located. Mr. Clark estimates his loss at $20,000; insurance $17,000.

Milford, Conn.—Work has been resumed at the works of the National Electrical Manufacturing Company. A number of good sized orders are said to have been received.

New York.—The Babcock & Wilcox Company will be awarded a contract from the Electric Lighting Committee of Edinburgh, Scot., for steam and exhaust pipe. The value of the contract is said to be $13,130. Everything else required by the committee will be purchased in Scotland or England.

Pittsfield, Mass.—The delicate machinery in the laboratory of William Stanley, Jr., was somewhat damaged by a fire that occurred a few days ago in the block in which the laboratory is located. The extent of the damage could not be fully ascertained as Mr. Stanley was ill at his home and could give no estimate.

Roselle, N. J.—The New Orange Company has broken ground here for a large factory for the Oxley & Enos Company of New York, manufacturers of electrical fittings.

Washington, D. C.—The Bureau of American Republics has been informed that Mr. James G. Kelley has applied to the municipality of Buenos Ayres for a concession to construct two underground electric railways in that city. The roads are to be ready for use within three years after the granting of the concession. Six per cent. of the total receipts are to accrue to the municipality. Both lines, with the entire plant and all rolling stock, shall become the absolute property of the municipality, free of any claim or compensation, at the expiration of 99 years.

TRANSMISSION PLANTS.

Canal Dover, O.—Leiser & Bowers, well known millers, have decided to build an electric light and power plant on a large scale. The plant will be erected on the site of their recently burned flouring mill on the Tuscarawas River and the water power there will be used to generate electricity. It is proposed to wire the electricity and furnish power to all parts of the county, and if subscribers in sufficient number can be secured the cost of light and power will be reduced to the minimum, and the promoters say this will be scarcely one-half the figures now charged.

Seattle, Wash.—Work is progressing on the Snowqualmie Falls electric power system, but the delay in getting a franchise from the city of Seattle is causing the company some uneasiness, and they are withholding all orders for machinery until they are assured of the council's favorable action.

COMPANY MATTERS.

Hartford, Conn.—The Bryant Electric Company has increased its capital stock from $75,000 to $100,000.

Lynchburg, Va.—A meeting of capitalists of New York and other places who are interested in the property recently purchased from the Lynchburg Electric Company, including a street railroad, will be held here on July 26th for the purpose of organizing and electing officers of a new corporation to be known as the Lynchburg Electric and Light Company.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—The survey of the Albany, Helderberg and Schoharie proposed electric road has been completed by the engineer corps under Chief Engineer H. H. Schermerhorn. Everything is being arranged so that as soon as the right of way is secured the Albany Construction Company, to whom has been awarded the contract to build the road, may be able to begin work.

Troy, N. Y.—The E. G. Bernard Company has closed a contract for electric motive power for the Washington Navy Yard.

Lansingburgh, N. Y.—The directors of the Beacon Electric Company have declared a quarterly dividend of one and one-half per cent. The proposed plan of extending the plant was left to a committee with power. The day service will be in operation as soon as the dynamos can be placed.

Schenectady, N. Y.—The General Electric Company will make this week the first shipment of the machinery to fulfill its contract with a railroad company in London, Eng. This installation is to be done by the employees of the company's English office. The locomotives to be used are similar to those used on the Baltimore & Ohio Railroad in the tunnel at Baltimore.

PERSONAL AND MISCELLANEA.

Robert T. Lee of Newport, R. I., has been chosen to fill the vacancy caused by the resignation of Mr. Townsend as superintendent of the Woronoco Street Railway Company. Mr. Townsend goes to Meriden, Conn.

Ernest Grauer, the electrician who miraculously escaped death in the explosion of the Pompton powder mills, is slowly recovering from the effects of the shock at his home in Brooklyn, N. Y. Grauer had been employed about the Pompton works off and on during the summer. He attended to the electric lighting plant and had been making some repairs to the wires just before the explosion occurred. The force of the latter hurled him against the wall of the factory office and thence back again under a table in the middle of the room, but beyond a few scratches and some severe bruises he was unharmed.

Edward Lauterbach, A. J. Dittenhoefer and Herbert R. Limburger, of New York, have issued a statement in defence of the character of Dr. Cornelius Herz, who died in Bournemouth, England, recently. It says Dr. Herz was a citizen of the United States, and though accused by the French Government of complicity in the Panama Canal scandal, was never connected with the Panama Company, financially or otherwise. The charge of extortion practised upon Baron Reinach before his death is alleged to have been trumped up against Dr. Herz in order to procure his extradition to France, and official documents are quoted to show that the charge was dismissed by Sir John Bridge, an English magistrate.

"Electric fans have probably come to stay," remarked an electrician to a Washington "Star" reporter, "and though they are decidedly pleasant to many during stuffy and very warm weather, there are some things about them that are not thoroughly enjoyable as far as after effects are concerned. My experience is that persons should not sit for any long time in the direct draught of them, especially if they are sensitive to draughts. It may not always feel so, but the fan is just as cooling if the wind produced by it does not strike you directly. Better have it strike you from either side, however, than full in the face or back, and especially avoid having it play on the back of your neck. People who are suffering from neuralgia have found this out for themselves. There is a peculiarity about electric fans, and that is that persons sitting so the wind plays on them directly in nine cases out of ten will have a slight attack of sneezing the moment they go out in the open air. If the circulation is above the head it is better than if it is on the level of your head."

The Detroit "Free Press" gives the following as "a lesson in electricity": "There was a small boy on Ledyard street Saturday that learned something about electricity in a very short time. A youngster just at the 'cute' age sat on a horse-block sprinkling the street and every now and then seeing how near he could throw a stream of water to occupants of passing carriages without hitting them. He sat with the hose under him and as an electric car approached he bethought himself of an idea. He waited until the car was almost in front of him and then turned the stream into the motor. The effect was pleasing to those who had been watching him. The instant the water struck the exposed portion of the motor the boy rose nearly a foot in the air. He let out an ear splitting yell, and dropping the hose, started as fast as his legs could carry him up the street. In that short space of time he had learned that water is an excellent electrical conductor, that electricity will follow a stream of water back to the hose, and that if anyone has hold of a brass nozzle he will get a shock."

RECENT COMPANY ELECTIONS.

Orange & Passaic Valley Railway Company, Orange, N. J.—President, Charles A. Sterling; vice-president, William Scheerer; secretary and treasurer, John H. Ely.

Cumberland Electric Railway Company, Cumberland, Md.—President, George L. Wellington; vice-president, Lloyd Lowndes; secretary and treasurer, J. H. Holzsher; directors: the officers and James A. McHenry and W. M. Roberts, Jr.

Metropolitan Railway Company, Washington, D. C.—President, Robert D. Weaver; vice-president, A. B. Grunwell. These and Nathaniel Wilson, W. B. Gurley, S. T. Brown, John Cammack, John Joy Edson and W. J. Spence comprise the new board of directors.

COMMERCIAL PARAGRAPHS.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

INCORPORATIONS.

The Framingham, Southboro & Marlboro Street Railway Company, Framingham, Mass.—to construct and operate a street railway nine miles in length. Capital stock, $120,000. Directors: S. H. Howe, F. D. Newton, C. B. Sawin, J. R. Entwistle, W. B. Ferguson, C. E. Barnes and G. A. Butman.

The Colby Electric Manufacturing Company, Chicago, has certified to a change of name to the Chicago Non-Refillable Bottle Stopper Company.

The Ballard Electric Company, Chicago, has certified to a change of name to the Wells-Goodhue Company.

The Standard Electric Repair & Construction Company, Cleveland, O.—to manufacture and repair electrical apparatus, appliances, etc. Capital stock, $1,000. Incorporators: Lewis Sands, William J. Bowen, James O. Jones, C. A. Bejock and F. B. Skeels.

The Dayton & Germantown Traction Company, Dayton, O.—to do a general passenger, freight, mail and express business between Dayton and Georgetown. Capital stock, $10,000. Incorporators: Fred Shoap, Isaac Bassett, Noah Caler, P. T. Meredith and Theodore C. Lendsey.

The Vigo Light & Power Company, Terre Haute, Ind.—to generate and manufacture electric light, heat and power. Capital stock, $50,000. Incorporators: William R. McKeen, Herman Hullman, James R., Andrew H. and James A. Crawford.

The East St. Louis & Collinsville Electric Railway Company, East St Louis—to build and operate an electrical railroad from East St. Louis to Collinsville. Capital stock, $2,500. Incorporators: William Ortgier, T. T. Ramey and W. E. Hadley.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 12, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

607,065. Trolley for Third Rails. Lowell E. Maxham, Boston, Mass. Filed Sept. 1, 1897.

607,191. Trolley. William H. Russell, Chicago, Ill. Filed May 21, 1897.

607,351. Electric Railway. William W. Doty, New York, James A. MacKnight, Mount Vernon, and Charles Grauten, New York, assignors, by mesne assignments, to W. W. Doty & Co. and William Reinhart, New York City. Filed Jan. 25, 1897. Renewed Dec. 24, 1897.

607,387. Trolley for Electric Railways. Henry Van Hoevenbergh, New York City. Filed Aug. 31, 1897.

607,118. Car-Fender. William H. Martin, Los Angeles, Cal. Filed March 31, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

607,036. Electric Controlling Apparatus for Switch-Valves. Elmo G. Harris, Rolla, Mo. Filed Sept. 25, 1897.

607,121. Automatic Cut-Out for Secondary Batteries. Walter L. Negbaur, Brookline, Mass. Filed Feb. 19, 1897.

607,125. Method of and Apparatus for Generating Electricity. Walter L. Negbaur, Brookline, and Joseph J. Feely, Walpole, Mass. Filed June 17, 1897.

607,176. Electric Break for Induction-Coils. Thomas B. Kinraide, Boston, Mass Filed Feb. 26, 1897.

607,177. Electric Break and Induction Apparatus. Thomas B. Kinraide, Boston, Mass. Filed July 26, 1897.

607,185. Electric Meter. William D. Marks, Philadelphia, Pa., assignor to the American Electric Meter Company, same place. Filed Nov. 4, 1897.

607,213. X-Ray Apparatus. Henry Green, Hartford, Conn. Filed Sept. 30, 1896.

607,247. Electric Motor. Warren S. Johnson and Henry Winkenwerder, Milwaukee, Wis., assignors to the Johnson Electric Service Company, same place. Filed Nov. 9, 1896. Renewed June 1, 1898.

607,250. Electric Cut-Out. Harry A. Lewis, Norristown, Pa., assignor of three-fifths to John T. Dyer, same place. Filed July 14, 1897.

607,251. Fuse-Holder, Circuit-Breaker and Lightning-Arrester. Harry A. Lewis, Norristown, Pa., assignor of three-fifths to John T. Dyer, same place. Filed July 11, 1897.

607,311. Electric-Current Controller. Ernest E. Werner, Philadelphia, Pa., assignor, by mesne assignments, to S. Eldred Gilbert and Samuel I. Shute, same place. Filed Feb. 23, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

607,239. Telegraph. Leo W. Hildburgh, New York City. Filed June 2, 1897.

MISCELLANEOUS.

607,018. Underground Electric Conduit. Thomas Connelly, Chicago, Ill. Filed Nov. 12, 1897.

607,007. Apparatus for Manufacturing Ozone. Emile Andreoli, London, England. Filed Oct. 15, 1897.

607,070. Electric Cable for Driving Conveyances. Addison Norman, Toronto, Canada, assignor of one-fourth to William McCabe, same place. Filed April 19, 1897.

607,078. Electrode-Plate for Electric Accumulators. Paul F. Ribbe, Berlin, Germany. Filed Jan. 25, 1898.

607,093. Electrically-Heated Roll. Fred P. Snow, Lynn, Mass. Filed May 3, 1897.

607,302. Electric Locomotion. Harry Van Hoevenbergh, New York City, assignor to Noah C. Rogers, same place. Filed Nov. 20, 1896.

607,315. Insulator. Charles L. Wingard, Walla Walla, Wash., assignor of one-half to Luella Hulme Wingard, same place. Filed April 13, 1898.

607,343. Switchboard and Alarm Mechanism. John P. Conway, New York City. Filed May 5, 1897.

607,407. Alarm System. Clyde Coleman, Chicago, Ill., assignor, by mesne assignments, of two-thirds to George P. Jones, same place. Filed Oct. 18, 1897.

RE-ISSUE.

11,678. Electric Signaling Mechanism. Lewis G. Rowand, Camden, N. J. Filed Dec. 15, 1897. Original No. 593,692, dated Nov. 16, 1897.

DESIGN.

29,046. Electric-Light Sign. Mortimer Norden, New York City, assignor to Joseph Norden, same place. Filed May 16, 1898.

TELEPHONE AND TELEGRAPH.

The hearing in the suit of the Western Electric Company of Chicago, to restrain the Detroit Telephone Company from using certain devices which, it is claimed, infringe the patents held by it and the Bell Telephone Company, was resumed before Judge Swan at Detroit on the 13th. The "busy" device, by which the telephone girl is enabled to tell whether a line is in use or not, is the only patent under discussion. It was argued by the defence that it would be an injustice to grant the temporary injunction, especially as some of the patents expire in six months and numerous electrical experts had testified that there was no infringement. It was also urged that in view of the extensive use of the new telephones in Detroit and elsewhere any interference with their operation would be a hardship to the people that the facts in the case would not warrant.

Contracts are being made by the Bell Telephone Company of Missouri with St. Louis druggists for the placing of automatic telephones in their places of business. The subscriber agrees to collect tolls to pay to the company, and in full of compensation the company agrees to pay the subscriber a commission of 10 per cent. on all receipts for messages sent from each station to some other station in the cities of St. Louis or East St. Louis, connected with an exchange of the company, and also on long distance messages. The company will attach to each 'phone a coin-receiving device for messages, the same as are now in operation in other cities. It is stated that the machines in question have been shipped to St. Louis, and will be in operation not later than August 15.

Notice of the signing of a contract by the Executive Council of the Hawaiian Government granting the right to lay a cable between Hawaii, the United States, Japan and China to the Pacific Cable Company of New York, was received at the office of the company in New York last Thursday. This news, according to the *Herald*, was contained in a despatch from W. G. Irwin, Honolulu, forwarded by wire from Victoria, B. C., which said that the contract was signed on July 2, and that it grants exclusive cable rights between Hawaii, Japan and the necessary islands in the Pacific Ocean for twenty years. The directors of the Pacific Cable Company are James Scrymser, Edmund L. Baylis, Admiral John Erwin, J. Pierpont Morgan and J. Kennedy Tod. Mr. Scrymser is its president and Mr. Baylis its vice-president. Its capital is $10,000,000, and it was incorporated under the laws of New York.

The Philadelphia councils have finally passed the ordinance granting permission to the Drawbaugh Telephone Company to establish a service in that city in opposition to the Bell Telephone Company's business. The first application for the privileges granted was made as far back as 1884, but was so loaded down with conditions that successful competition against the Bell service would have been impossible. The new company is also considerably restricted. It must pay the city 3 per cent. of its gross receipts, give a bond more than twice as large as the Bell Company, and charge a maximum of $75 per annum to subscribers. The Bell Company now charges what it likes, and the cost is at present $120 per annum.

The Iowa Telephone Company has threatened the city of Des Moines with a lawsuit to test the right of the city to prevent its use of the streets, alleys etc., for the erection of poles and wires required in its operations. The council in passing the ordinance depriving the company of these privileges took the ground that the company had no franchise and was therefore an interloper. The telephone company takes the position that the city has been tardy in finding this out, has permitted the company to prosecute the work of building and operating an exchange, and that as a result it has a vested right of which it cannot be deprived.

Bonds of the Cumberland Telephone & Telegraph Company are being offered in Boston by Parkinson & Burr. The company is capitalized for $3,000,000 stock ($2,875,000 outstanding) and has a bonded indebtedness of $1,000,000 In March last the company absorbed the Great Southern Telephone Company, and is stated to have now 16,000 exchange stations under its control. It operates through the southern portions of Indiana and Illinois, the western portions of Kentucky and Tennessee and the entire States of Mississippi and Louisiana. It is a Bell licensee company.

The St. Paul board of aldermen has passed a resolution naming the streets that can be used by the Mississippi Valley Telephone Company. There was some doubt as to whether the company had not forfeited its franchise by its tardiness, but on being assured that it had really begun work the aldermen passed the resolution referred to by a unanimous vote.

A press dispatch from Des Moines states that a movement is on foot for the consolidation of all independent telephone toll lines in Iowa under one management and the merging of the several companies into one big organization. Propositions for the proposed consolidation have been forwarded to the management of a number of lines, with every indication that they will be accepted, and that a meeting to outline the plan of consolidation will be called in Des Moines at an early date. The nucleus will probably be the Central Telephone Company of Des Moines.

We learn from a Boonville dispatch in the Utica *Observer* that arrangements are about completed whereby the Boonville Telephone Company, which obtained a twenty year franchise, gives up all its right, title and interest to the Central New York Telephone Company, which has done some wiring and expects soon to have an exchange in operation. The consideration is not known, but it is reported that the Central Company takes the pole and telephone apparatus which the Boonville Company had purchased with the idea of starting an exchange.

A new telephone combination has been formed at Greenville, S. C. George A. Browning, president of the Green ville Home Telephone Company, and his associates have organized the Piedmont Telephone & Telegraph Company. The new company will have exchanges at Anderson, Abbeville, Greenwood, Laurens, Alston, Newberry, Gaffney and Spartanburg and intermediate points. These exchanges will be connected with metallic circuit and long distance 'phones.

The Mamaroneck, N. Y., trustees have received an application from George W. Sutton, of New Rochelle, to establish a local telephone company. Telephones are to be rented for $36 a year, or $3 a month, and the village is to have the free use of two instruments and the poles for a fire-alarm system. The application was referred to the corporation counsel.

The city council of Lexington, Ky., has passed a resolution authorizing the Mayor to enter into a contract with the East Tennessee Telephone Company for the grant of a telephone franchise for twenty-five years at an annual rental of $1,200. The Standard Telephone Company was the only competing applicant for the franchise, offering a number of free 'phones to the city and an annual payment of $500.

J. A. Helvin, the promoter of the proposed underground telephone system at Chattanooga., Tenn., who is recovering from a critical illness, is expected at Chattanooga this week. He is said to be sanguine of the success of his telephone enterprise, for which, it will be remembered, he secured a franchise a few weeks ago.

The American Telephone & Telegraph Company has moved its division headquarters from Cincinnati to St. Louis, and this is considered as an indication that St. Louis, which was formerly only a station in the district, handled from Chicago, is to become a telephone center.

The police and fire department wires at Syracuse, N. Y., will be placed in the Central New York Telegraph & Telephone Company's subways. The company has reserved a duct in its subways for the free use of the city.

The Mutual Telephone Company of Des Moines has determined to put in a new switchboard to accommodate 1,500 patrons. Its present board is only fitted for 800, and the business demands increased capacity.

It is stated that the large demand for insulated wire for Government uses has delayed the work of the Kinloch Telephone Company at St. Louis, and will prevent the opening of the lines at the time expected, August 1.

A telephone exchange is being erected at Eatonton, Ga., by E. H. Davis, the city superintendent of waterworks, who will be the manager. Connections with the larger cities of the State will be made as soon as the exchange is on a solid working basis.

The Crescent City Telephone Company has made a proposition to the council of Evansville, Ind., to put in a first-class telephone exchange in that city if granted a franchise.

The Red Wing Telephone Company, composed of H. L. Sumptur and Irving Todd, Jr., of Hastings, has been granted a telephone franchise by the city council of Red Wing, Minn.

Tishomingo, I. T., is now connected with the outside world by telephone, the line from Ardmore having been completed and a 'phone put in at the Chickasaw capital.

A telephone cable has been laid between Block Island and Narragansett Pier.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by Electricity from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; * inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—July 18:						
Albany Ry. Co	100	2,000,000	1,750,000	1½ % Q., Feb. '98.	142½	146
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	68	70
Traction Co. (Saratoga)	100	50,000	50,000	....	..	..
Allentown, Pa.—July 18:						
Allentown & Lehigh Val. Trac. Co.	..	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—July 18:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	85	..
Baltimore, Md.—July 18:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '97.	..	72½
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23⅛	23⅜
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—July 18:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	...	..
North Shore Traction Co......com.	100	4,000,000	4,000,000		10	14
North Shore Traction Co......pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	72	75
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	85¼	85½
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	105	106
Boston Elevated R. R.	100	10,000,000			65½	66½
Brooklyn N. Y.—July 18:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	201	205
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	54⅝	54¾
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR......guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	209	210½
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	...	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	205	..
Kings County Elevated	....	4,750,000	4,750,000	....	8	..
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	47	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	87	...
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	74	80
Buffalo, N. Y.—July 18:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	55	60
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	80	82
Columbus O.—July 18:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb., '98.	49	50
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—July 18:						
Charleston City Ry. Co	50	100,000	100,000	8 % S., Jan., '97.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—July 18:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	269	275
Chicago & South Side R. T. RR.	100	10,828,800	10,828,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12½	18
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	3
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan., 98.	210	212
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	18,189,000	1½ % Q., Feb, 98.	92	92½
jChicago West Div. Ry......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—July 18:						
Cincinnati Inc. Plane Ry......com.	50	1,000,000	575,000		..	20
Cincinnati Inc. Plane Ry......pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000		23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	114¼	114½
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—July 18:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	37	39
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '97.	56¾	62½
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	59½	60
Detroit, Mich.—July 18:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000		..	100
Detroit Electric Railway	....	1,000,000	1,000,000		...	..
Wyandotte & Detroit River Ry	100	250,000	200,000		100	110
Dayton O.—July 18:						
City Railway Co...........com.	100	1,500,000	1,470,600	1¼ % Q., Jan. 1, '98.	100	102
City Railway Co...........pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	150	155
People's Street Railway	....	1,100,000	....	....	100	..

*Unlisted. †Ex div.
a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Walbrook, Gwynn Oak & Powhatan Railway and Park.
b Leased to Boston Elevated Railroad Company.
c Owned by Brooklyn Rapid Transit Company.
d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.
e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR
g Owned by Atlantic Ave. RR. and leased to Nassau system.
h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.
i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.
k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, ass ming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—July 18:						
Hartford Street Ry. Co	100	$4,000,000	‡200,000	8 % S., Jan., '98.	140	--
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	--
Holyoke Mass.—July 18:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—July 18:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	--
Indianapolis, Ind—July 18.						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	27	30
Lancaster, Pa.—July 18:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	--
Lancaster & Col. Electric Ry	....	....	87,500	....	..	--
West End Street Railway	....	....	....	....	..	--
Louisville, Ky.—July 18:						
Louisville Ry..................com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	37	38
Louisville Ry..............5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	97½	98
Minneapolis, Minn.—July 18:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	18	23
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,714,200	1¾ %, Jan., '98.	..	100
Montreal, Canada.—July 18:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	261¾	265½
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	96¾	97¼
Memphis, Tenn.—July 18:						
Memphis Street Railway Co	100	500,000	500,000	....	15	--
New Haven, Conn.—July 18						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	--
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—July 18:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	146	170
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	1	4
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	5	10
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	82
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	85	88
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	18	22
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	58	54½
New York—July 18.						
Central Crosstown RR	100	600,000	600,000	2½ % Q., July, '97.	250	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Jan., '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98.	175	195
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Jan., 98.	149	149½
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	82¼	84
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	211½	215
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98.	180	185
hEighth Avenue RR	100	1,000,000	1,000,000	....	335	350
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q., Feb., '98.	330	360
jNinth Avenue RR..........guar.	100	800,000	800,000	....	180	..
kSixth Avenue RR..........guar	100	2,000,000	2,000,000	....	200	210
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q. Feb., '98.	325	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., Jan., '98.	172½	...
Third Avenue RR	100	12,000,000	10,000,000	2 % Q., Feb., '98.	175	180
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	60	63
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—July 18						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	48½	49½
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—July 18:						
Allegheny Traction Co	50	500,000	500,000	....	48	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	14⅝	14¾
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	48¾	49½
pCentral Traction Co	50	1,500,000	|900,000	....	...	...
qCitizens' Traction Co	50	3,000,000	‡3,000,000	6 % A.	62¼	...
rDuquesne Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	8 %, Aug., '95.	..	...
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	24	25
Pgh., Allegheny & Man. Trac. Co	50	3,000,000	|2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry	25	3,000,000	3,000,000	½ %, Jan., '96.	18⅞	19¾
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 97.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	300,000	200,000	....	..	..

*Unlisted. ‡Full paid. | Outstanding. †Ex div.
a Leased to New Orleans Traction Company at 6 % on stock.
b Leased to New Orleans Traction Company at 8 % on stock.
c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.
d Operating the former Met. Trac. system, that corporation having become extinct.
e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.
i Leased to Metropolitan Street Railway for 18 % on stock.
j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
k Leased to Metropolitan Street Railway for $145,000 per annum.
l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
m Controlled by Third Avenue Railroad by purchase.
n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.
o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co
p Leased to Consolidated Traction Company for 8 % per annum on par value of stock
q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.
r Leased to Consolidated Traction Company for 4 % on capital stock after October,
s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—July 18						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	158
Northampton, Mass—July 18						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	168	175
Omaha, Neb.—July 18:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—July 18:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	85	86
Providence, R. I.—July 18						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	61	67
Philadelphia.—July 18:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14⅛	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '97.	43½	45
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	†533,900	3 % S—Jan, 10, '98.	65½	66
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	65	66
Union Traction Co.......... $12½ pd	50	30,000,000	29,930,450	....	17½	17⅝
cElectric Traction Co	50	....	8,297,920	....	71⅜	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.97	390	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 97	256	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '97.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135⅛	..
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	135	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	87¼	8.¾
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '97.	...	..
jContinental Pass. Ry.....guar..	50	1,000,000	‖580,000	$6 share—July, '97.	142½	..
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '97	175	180
jPhiladelphia & Gray's Fy. RR..	50	1,000,000	298,650	$3.50 share July '97	90¼	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '97.	288	390
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '97.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1⅛ % S., July, '97.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '97	275	...
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '97	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '97	225	230
Rochester, N. Y.—July 18:						
Rochester Railway Co	100	5,000,000	5,000,000	....	10	12
Reading, Pa.—July 18:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	64	..
St. Louis Mo.—July 18:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Jan., 98.	125	127
National Railway Co	..	2,500,000	2,479,000	1½ %, Jan., '98.	..	----
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '98.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, Jan., '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % Jan., '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry..........com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	1½ %, Jan., '98.	110	112
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	54	56
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—July.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	107	108
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅝	53¾
Presidio & Ferries RR	100	1,000,000	550,000	....	...	8⅛
Scranton, Pa—July 18:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
m Scranton & Carbondale Trac. Co..	100	500,000	500,000	....	..	18
m Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—July 18:						
Springfield Consolidated Ry	100	750,000	750,000	....	----	11
Springfield O.—July 18:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—July 18:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—July 18:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	96¾	97⅛
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	264¼	265⅛
Washington, D. C.—July 18:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	73⅛	74
Columbia Ry. Co	50	400,000	400,000	6 % A.	77	78
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	121	123
Worcester, Mass.—July 18:						
*Worcester Traction Co.......com.	100	8,000,000	8,000,000	....	15½	17
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	8 % S., Feb., '98.	95	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—July 18:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—July 18:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., Jan., '98.	272	274
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	..	70
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Feb. '98.	133	..
New York.—July 18:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	94¼	95¼
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	100	108
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	170	180
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	44
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan.., '98.	68¼	70
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	108	110
*International Ocean Tel Co.guar6%	100	3,000,000	......	1½ % Q.	107	110
Mexican Telephone Co	100	2,000,000			.59½	.65
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	1½ % Q., Jan., '98.	148	151
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000		2 % S.	72	77
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	90	95
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	91¾	92⅛
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—July 18:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	170½	175
Chesapeake & Potomac Telep. Co	100	......	......	....	59½	60⅛
Chicago Telephone Co	100	......	......	....	202	..
Central Dist Prtg & Telg. Co. (Pgh.)	100	750,000	750,000	....	..	..
Empire & Bay States Telegraph Co.	...				72	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	70	72
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	110	115
Providence (R. I.) Teleph. Co	50		......	....	86	86⅛
Southern New Eng. Teleph. Co	100	8,000,000	......	....	119	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—July 18:						
Fort Wayne Electric Co	..	......	......	......	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25					
General Electric Co............com.	100	40,000,000	30,460,000	2 % Q., Aug., 1893.	38¼	38⅛
General Electric Co............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	94	96
T.-H. Elec. Co..T. Secur., Series D.					2½	8
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700		24½	25
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., July, '98.	54½	55
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126			
New York.—July 18:						
Edison Elec. Ill'g Co., New York..	100	9,188,000	7,988,000	....	130	135
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	4,000,000	1½ % Oct., '97.	122½	...
Edison Ore Milling Co	100	......	......		10	18
Edison Electric Storage Co					22	25
General Electric Co............com.	100	40,000,000	30,460,000	2 % Q., Aug, 1893.	38½	38⅛
General Electric Co............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	94	96
Interior Conduit & Insulation Co	100	1,000,000	1,000,000		41	
United Elec. Lt. & Pow. Co....pfd	..	......	......		..	..
Pittsburg, Pa.—July 18:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	180	..
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—July 18:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	29½	30
*Electric Storage Battery Co...pfd.	100	8,500,000	......	......	32	33
*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	..
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co..	10	6,500,000	550,000	$82500 dis. Jan.11'97	13½	14
Southern Elec. Light & Power Co..	10	187,500	187,500	....	8	10
Miscellaneous.—July 18:						
Brush Electric Co	50	......	......	......		
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	32½	35
Missouri-Edison (St. Louis)....com.		......	......	......	11	15
Eddy Electric Mfg. Co	25	......	......	......		15
Hartford (Conn.) Elec. Light Co	100	850,000	......	......	120	130
Hartford (Conn.) Lt. & Power Co	25	175,000	......	......	4½	10
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	......	160	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	83	90
Rhode Island Elec. Protec. Co	100	......	......	......	110	120
Royal Elec. Co. (Montreal)	..	1,000,000	......	2½ Q	*158	160
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	136½	136½
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	100	110

*ex d.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—July 18:						
American Electric Heating Co	50	10,000,000		....	.05	.07
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$8 per sh. Feb.1, '98	35	37
United Electric Securities Co...pfd.	100	......	......	3½ % Feb., '96.	..	..
New York.—July 18:						
Consolidated Electric Storage Co	..	......	......	....	18	20
Edison European	..	......	......	....	1	8
Safety Car Heating & Lighting Co	100	......	......	....	..	98¾
Worthington Pump Co..........com.	100	5,500,000	5,500,000	....	30	33
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	90	92
Philadelphia, Pa.—July 18:						
Acetylene L. H. & P. Co.....$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74⅛	..
Welsbach Commercial Co......com.	100	8,500,000	......	....	18	20
Welsbach Commercial Co......pfd.	100	3,000,000	......	2 % Q	75	..
Welsbach Light Co	5	525,100	......	....	55	56
Welsbach Light Co., Canada.	5	500,000	......	....	1½	1¾
Pittsburg, Pa.—July 18:						
Carborundum Mfg. Co	100	200,000	200,000			
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	110	112
Miscellaneous.—July 18:						
*Barney & Smith Car Co......com.	100	......	1,000,000	....	..	15
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	..	65
Billings & Spencer Co	25	......	......	....	30	37
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	30	35
Johns-Pratt Co	100	......	......	....	..	97
*Pratt & Whitney Co..........com.	100	......	......	....	..	10
*Pratt & Whitney Co..........pfd	100	......	......	....	45	51
Stillwell-Bierce Co..........com.	..	......	......	....	96	98
Stillwell-Bierce Co..........pfd.	..	......	......	2 % Sept. 1, '97.	107	109
Shults Belting Co	100	800,000	......	....	80	90
St. Charles Car Co	..	......	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—July 18, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*111	......
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR.1st mtg. 6s	350,000	350,000	1919	M. & N.	*117½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co...................1st 5s	....	....	......	......	*105	105½

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—July 18, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113½	114
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	113½	114
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103½	104
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116½
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	102¼	102¾
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co...........1st mtg. 6s.	96,000	117,000	1912	J. & J.	......	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	116	117
City & Suburban Ry......1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	114	......
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	....
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	118	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	101½	105
West End Street Ry........Deben. g. 5s.	8,000,000	3,000,000	1902	M.& N.	104	105
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	.....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry...........1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¼	102¼
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	103½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	54	54¾
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	104	104¼
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	104½	....
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	99¼	99⅞
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	91
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	102	102½
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	108
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,C00	531,000	1906	M. & S.	107¼	108½
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	‹9	......
‖So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	:8)	132

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	102	102½
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103½	105
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
aEast Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	(02	105
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	....
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 6s.	100,000	94,000	1909	M. & S.	102	......

New Orleans La.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR..........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	101	....
Crescent City RR...........1st mtg. 6s.	......	50,000	1899	M. & N.	100¼	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	76	79
New Orleans City RR..........1st mtg. 6s.	416,500	399,000	1903	J. & D.	105	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100¼	101¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	110	....
Orleans Railroad Co........Cons. mtg. 6s.	800,000	300,000	1912	J. & J.	101½	....
‡St. Charles St. RR. Co........1st. mtg. 6s.	300,000	75,000	1906	J. & D.	104½	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87
Atlantic Av. (Brooklyn).1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	106	109
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	101½	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	114	117
Broadway Surface..............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	113	115
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	112½	113½
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	87
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	103	....
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	105½	108
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	103½	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	101	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	110	113
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	120	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100	*103
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115	118
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	95
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	117½	122
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1°,500,000	1997	F. & A.	114½	115
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600 000	1909	M. & N.	108½	109½
Second Avenue Ry.............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	107	......
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	121	122½
Twenty-third Street Ry.........1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	103	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	111	113
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112½

†$1,085,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.......................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry.....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	102	108
Phila. City Passenger Ry......1st mtg. 5s.	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co.................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	88	......
Central Traction Co...............1st mtg. 5s.	375,000	375,000	1930	J. &. J	......	....
Citizens' Traction Co..............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	107	107½
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	105¼	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	105	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	101	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	102¾	103
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co......................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation—July 18, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	100½	101½
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	101½	102½
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1918	J. & J.	111	112½

*With interest. 'Unlisted.

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—July 18, 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	850,000	850,000	1908	J. & J.	80	85
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co....................1st mtg. 5s	1,500,000	1,500.000	1911	F. & A.	106	107
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	106	107
‡Mound City RR. Co............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	108
People's RR. Co....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co...............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry...............Income 5s.	800,000	800,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110½	111½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	108½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation— July, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	118	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	117
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	....	102
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	127	129½
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127½	130
†Park & Cliff House RR.......1st mtg. 6s.	850,000	850,000	1912	J. & J.	108½	......
†Park & Ocean RR...............1st mtg. 6s.	250,000	250 000	1914	J. & J.	110	115
†Powell St. Ry......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	117½	120
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109¾	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—July 18, 1898.						
Belt Ry. Co......................Cons mtg 5s.	500,000	450,000	1920	J. & J.	45	....
Columbia Ry..........................1st mtg. 6s.	500,000	500,000	1914	A. & O.	118	....
Eckington & Soldiers' Home, 1st mtg. 6s.	200,000	200,000	1911	J. & D.	95	100
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	117½	119½
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—July 18, 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	109	111
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	107	109
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	95	100
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	104	104½
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	96	98
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	....	......
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	70	78
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	110½	111
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	89	93
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	3,000,000	2,878,000	1928	J. & J.	100	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	90	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	112	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	95½	....
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	89	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	85	92½
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—July 18, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	108	....
Pittsburg, Pa.						
Date of Quotation—July 18, 1898						
Allegheny County Light Co..............6s.	500,000	......	1911	J. & J.	105	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(July 18, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	110	...
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	115½	......
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	108	......
Edison Illg. Co. (St. Louis)..............	4,000,000	......	1928	F. & A.	60	61
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	75	90

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—July 18. 1898.						
American Bell Telephone....................7s.			1898	F. & A.	100¼	....
Northwestern Telegraph Co.................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	108	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108½	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—July 18, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co....................	....	....	......	......	......	25
*Barney & Smith Car Co....................†6s	....	......	1942	J. & J.	95	100
Carborundum Mfg. Co.......................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co..........................	75,000	......	......	......	....	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11⅜@11½c.; Lake, 11⅝c.; casting, 11⅛@11¼c.

The Central Printing District Telephone Company has declared a regular quarterly dividend of 2 per cent., payable to stock of record July 14.

The United Electric Securities Company, Boston, has retired the following bonds: Seventeen, series 5, at 99.19; 110, series 8, at 102.25; 112, series 9, at 102.06.

The Albany (N. Y.) Railway Company has declared the regular quarterly dividend of 1½ per cent. and an extra 1½ per cent., payable August 1 to stock of record July 21. Books open August 2.

The Edison Electric Illuminating Company of New York reports for June: Gross earnings, $215,156; operating expenses, $135,721; net earnings, $79,435, an increase of $16,230 over the net earnings for the same month in 1897.

Justice Dickey of the Supreme Court of Brooklyn has appointed J. Van Smith receiver of the Staten Island Rapid Transit Company. This is in line with the reorganization of the Baltimore & Ohio, of which system the Staten Island road is a part.

The New England Telephone & Telegraph Company of New York filed on the 14th inst. with the Secretary of State at Albany a certificate of an increase of its capital stock from $12,000,000 to $15,000,000. The debts and liabilities of the company amount to $3,505,404.

It is announced that the Westchester & Connecticut Traction Company has purchased the North Mount Vernon Railway Company's property and proposes to build a trolley road from Mount Vernon through Bronxville, Tuckahoe, Scarsdale and Hartsdale to White Plains.

The Consolidated Street Railway Company of Atlanta, Ga., is about to refund its 5 per cent. bonds at 4 per cent., and a proposition to this effect, says the "Journal," based on a surrender of a part of the stock to the bondholders, has received the assent of two-thirds of the parties interested.

The directors of the Edison Electric Illuminating Company of Boston, at their meeting on the 14th, declared quarterly dividend No. 37. They made it 2 per cent., payable August 1 to stockholders of record July 15. This is an increase of ½ of 1 per cent. over recent previous payments.

The amalgamation of the Municipal Electric Light Company with the Edison Electric Illuminating Company of Brooklyn has been completed, and substantially on the basis outlined in the circular issued by the Municipal Company to its stockholders on June 20. All or nearly all of the 75,000 shares of stock of the Municipal Company has been transferred.

The special meeting of Metropolitan Street Railway stockholders called to vote upon a proposition to increase the capital stock will be held in New York on August 9. The resolution offered will be to make the stock $45,000,000 instead of $30,000,000 as at present, an increase of $15,000,000. Ten million dollars of this sum is to be sold to the stockholders at par on the terms heretofore outlined, while $5,000,000 will be retained in the treasury.

The Appellate Division of the Supreme Court in Brooklyn, N. Y., has affirmed the judgment of the lower court upholding the traffic agreement by which the Brooklyn Heights and the Brooklyn City & Newtown Railroad companies have been using the trolley line tracks in Washington street. The plan was inaugurated when the bridge trolley system went into effect, and is intended to relieve the congestion of traffic in Fulton street.

The Metropolitan Street Railway Company, New York, has given public notice that it will, on July 20, begin the electrical construction on the Sixth and Eighth avenue lines south of 59th street, and that during such work the horse car lines on those avenues will be discontinued. In the meantime it will give its patrons extra facilities in the way of transfers, including east and west transfers.

On the 13th inst. all the property of the Columbia & Maryland Railroad Company was formally transferred to the Security & Trading Company and the $450,000 purchase money handed over. The company has now been divided into two lines, the Maryland Traction and the City & Suburban Railway Company controlling respectively the Washington and Baltimore branches. The Consolidated Railway Company of Baltimore has arranged to purchase the line between Baltimore and Ellicott City.

The assets of the Kings County Traction Company, consisting of 39,987 shares of the capital stock of the Atlantic Avenue Railroad Company of Brooklyn, N. Y., and the options upon the remaining thirteen shares of said capital stock, and options upon nine shares of the capital stock of the Brooklyn, Bath & West End Railroad, were sold at public auction on Thursday last for $2,100,000. The purchaser was E. H. Harriman, representing the directors of the company.

Judge O'Rourke, of the Circuit Court at Fort Wayne, Ind., on Wednesday last rendered a decision finding that John J. Shipherd, the Cleveland (O.) financier, had wrongfully appropriated, by himself and through banks, $990,000 worth of bonds of the Fort Wayne Consolidated Street Railway. The effect of the decision is to turn back into the assets of the company, now in the hands of receivers, that amount of bonds, to be used in paying legitimate liabilities. The Guardian Trust Company of Cleveland and banks of that city were the principal defendants, and they will attempt to get a new trial.

A dispatch from Schenectady, N. Y., states that the directors of the General Electric Company have issued a call for a meeting of stockholders, to be held in that city August 10, for the purpose of voting upon a proposition to reduce the capital stock of the company from the present amount, consisting of 304,600 shares of common stock of the par value of $100 each, and 42,520 shares of preferred stock of the par value of $100 each, to $20,827,200, which is to consist of 182,760 shares of common stock of the par value of $100 each, and 25,512 shares of the preferred stock of the par value of $100 each. The meeting, it is said, will be the most important ever held by the company.

The deal whereby the Kings County Electric Light & Power Company will absorb the Edison Electric Illuminating Company of Brooklyn is confirmed in a circular sent out on Saturday last by President Ethan Allen Doty of the Edison Company. The matter will be submitted to the stockholders of the companies as soon as the papers are prepared. The stockholders of the Edison Company will have the right to subscribe for 25 per cent. additional stock at par, and for the whole amount of stock they will then be offered par price in ninety-nine-year 6 per cents. Purchase money mortgage bonds will be secured by the deposit of the Edison stock so sold and additionally by a junior mortgage of the Kings County Company upon its property and further by the deposit of a guarantee fund of $1,000,000.

The Philadelphia "Stockholder" says, under the heading "When the War Ends": "This country seems ripe for a great expansion in business and the growth of new enterprises. The war with Spain, when it shall have ended, will, as the outlook now presents itself, add to both the glory and the confidence of the American people. There will be the incentive to activity which comes from consciousness of strength coupled with ambition. But not only is the incentive present, but there is also the money. Not in the financial history of the country has there been such an extraordinary amount of surplus funds. There will be money for all reasonable ventures, and some that are not reasonable, when the opportunity for lending at profitable rates has passed, as it will pass, with the restoration of peace."

ELECTRICITY.

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CONTENTS.

EDITORIAL NOTES.

Insulators. As is well known, the insulating power, or more properly speaking, dielectric strength, of any material with reference to a given current depends to a great extent upon the tension or energy of that current. This is essentially so in the case of insulation for conductors such as are found in the coils of high potential transformers. In the case of outside insulation however, where a conductor several miles in length carries a current of extremely high tension, the shape of the insulator plays an important part. Since the introduction of high tension transmission, or where a line transmits current at a pressure of from 10,000 to 20,000 volts, this question of properly insulating the conductor from its supports has become an exceedingly important one. Glass or porcelain has to be relied on almost entirely, although in some cases pottery or stone ware insulators have been used in foreign countries. None of these substances are by any means ideal, and especially glass, which is too brittle and very apt to be broken under a jerk or strain. One of the principal reasons apparently why glass is so extensively used on telegraph and other low tension transmission lines in this country at the present day is owing to its cheapness, and to the fact that for some unaccountable reason porcelain insulators in rural districts are said to be much sought after by certain insects who take up their abode under the hood and spin webs, and thus by connecting the insulator with the cross-arm offer in damp weather a path of escape to the current.

Owing to the brittleness of glass, so far on most of the very high tension transmission lines in this country porcelain is used. An early type of such insulator closely resembled in appearance a student's lamp shade, but these ultimately were done away with, as it was found that the drip from the outside of the insulator fell on the cross arm, and in case of a very heavy rain made a continuous stream which entailed an appreciable loss of current and frequently destroyed the insulator through overheating. With a view to overcoming this serious defect, what is known as the "helmet" type of insulator was brought out. This is oval in shape and so designed that all the drip in wet weather falls from two ends that hang out several inches from the cross-arm. Another form of porcelain insulator recently patented and intended for potentials ranging from 5,000 to 50,000 volts, is made in three separate parts fitted one into the other and fused together with glaze, the inner part being provided with a socket by which it is mounted. In this type of insulator the inner shell extends down to a point adjacent to the cross-arm, and forms a sleeve for the purpose of protecting the pin from static discharge or leaking of the current around the insulator.

On all telegraphic lines where glass or porcelain insulators are used there is, as is well known, always more or less leakage due to the insulator becoming damp through the condensation of the moisture of the air. In the case of a high potential transmission line, however, this accumulation of dampness on an insulator does not, as would naturally be inferred, cause a leakage providing the insulator is properly shaped. This is due to the fact that as soon as an insulator on such a line becomes moist and leakage tends to begin, static electricity is immediately formed, which heats the surface of the insulator and preserves comparatively large dry areas between the streams that run down from the falling drops.

This remarkable action of the drying of porcelain insulators by static electricity is probably one of the most valuable discoveries so far noted in the transmission of high potential currents.

* * *

The Nernst Electric Lamp. Dr. Johannes Horowitz, in a recent communication from Vienna to the New York *Times*, referring to the new electric lamp invented by Prof. Walter Nernst, makes the interesting statement that although all the rights and patents have been acquired by a Berlin syndicate at a price of 6,000,000 marks, or $1,-500,000, no practical or commercial use can as yet be made of the discovery. As we stated some time ago, in the Nernst lamp the carbon filament is entirely done away with, a conductor or filament of magnesia or other metal oxide that has been subjected to an intense heat being substituted. Referring to the metal oxides, Dr. Horowitz in his communication says:

"When in a conducive state such bodies allow the electric current to pass, and through it they are made to glow intensely by reason of the great light-emissive power possessed by the substances. Nernst's incandescent bodies have proved perfectly stable at the enormous temperature (more than 300 degrees centigrade) which is produced by electricity when these bodies are made to glow, a temperature at which platinum wire and carbon filaments become volatile and waste away. This renders it possible to produce a high degree of light intensity by means of a comparatively weak electric current, and the experiments already made have proved that we can reckon on an economy far surpassing that of the carbon filaments hitherto used. Unlike the ordinary incandescent lamp, the Nernst lamp will not require a vacuum, but will shine in the free air; indeed, the admission of air has proved to be advantageous, probably because the chemical changes brought about by the enormous heat, and especially the reduction of the incandescent substance, is compen-

sated when oxygen is taken from the air as a substitute."

Owing to a fear that electrolytic action would attend the use of the direct current, stress is laid in the patent specifications on the use of alternating currents. The Nernst lamp would seem to be a decidedly new departure in the field of electric lighting, and the further experiments that will necessarily have to be made along this line before this form of lamp can be utilized commercially, will unquestionably be watched with interest by the scientific world.

* * *

Atmospheric Electricity to Propel Street Cars?

Vol 14. p. 81,

Dr. William M. Gross of Gillespie, Ill., with his startling theory as to electricity, which we referred to at some length in an editorial in our issue of February 16, has again cropped up. He now proposes to build a tower 100 feet in height at Gillespie through which a wire about one-half inch in diameter will run. At the upper extremity of this wire a bunch of smaller wires will be attached by means of which he proposes to collect the electricity in the air. At the base of the tower will be located a machine, which the inventor calls an induction generator, to divert the current and prevent it from passing into the earth. The details of this generator have been kept secret, the visible feature however being a revolving disk two feet in diameter, which, according to the inventor, must travel in the reverse direction proportionally faster than the earth. It is Dr. Gross's opinion that enough electricity can be secured by one induction generator from the atmosphere to run a whole street-car system. As stated in our previous editorial, Dr. Gross is working upon the theory that electricity is dynamic and not static. The St. Louis *Post Dispatch*, which by the way seems to be the Doctor's mouthpiece, quotes him as follows:

"Static electricity belongs to bodies at rest. Its nature is to rise to the highest point upon the body. Dynamic electricity belongs to bodies in motion.

"The polar diameter being less than the equatorial diameter of the earth, its excess of electricity would blow off at the equator instead of at the poles, and we would no longer have the Northern and Southern lights.

"What probably occurs is, that as these currents pass around the earth through the atmosphere, they come in contact with dry areas, and as a dry atmosphere is a poor conductor of electricity it appears as a static charge and has been misleading to electricians.

"The earth and its atmosphere is the armature, and that portion of space between the earth and the sun is the electro-magnet of nature's grand dynamo-electric machine.

"The sun is shining on one-half the earth all the time. Its rays being vertical over some point of it at every instant, currents of electricity are induced out of that portion of space between the earth and the sun by the earth in its revolution from west to east. In accordance with the natural law governing electric currents, they go in an opposite direction, or from east to west.

"Lenz in 1833 demonstrated by a series of experiments that induced currents always go in the opposite direction to the electro-magnetic force producing them.

"These currents are brought down to and forced into the earth by its centrifugal force, which tends from its center toward the east, while the currents tend to its center and toward the west. When the center of the earth becomes surcharged with electricity, it flows off again at about the 70th parallel, producing the Northern and Southern lights.

"My machine is designed after the earth as a pattern. When placed at any point upon the surface and driven as required, it will be the earth's superior in centrifugal force and magnetism."

Dr. Gross's idea of collecting atmospheric electricity by means of a high metal rod is by no means new, as the French have been using in rural districts what they term a geomagnetifere, which consists of a high pole surmounted by a crown of copper spikes to which a suitable wire conductor is attached, for collecting and distributing atmospheric electricity to vegetables and plants. The amount of electricity collected by this means, however, is comparatively small under ordinary atmospheric conditions, and it is therefore rather difficult to see how Dr. Gross, in spite of his lengthy explanation and specially designed induction generator, proposes to obtain enough electricity from the atmosphere to propel a dozen or more electric cars. His experiments are worth watching however, owing to their being based on theories radically different from those generally admitted.

* * *

Probable Effect of the Omaha Exposition.

From all accounts the Trans-Mississippi and International Exposition, now being held at Omaha, is not suffering, as might be supposed, from lack of attention as a result of the war in which this country is at present engaged, as large numbers of people from all parts of the United States visit the Fair daily and display great interest in the exhibits, and especially those to be found in the electrical section, containing as they do a great variety of the latest and most useful inventions in this branch of industry. That this, the first Exposition of the kind to be held west of the Mississippi River, has so far proven an industrial and commercial success, with every prospect of proving a financial one likewise, cannot be doubted, and speaks well for the perseverance and executive abil ty of the promoters who could conceive and carry out such a gigantic undertaking during a time of more or less financial depression such as has been experienced the last few years. They are certainly deserving of great credit.

The importance of this Exposition from an educational and commercial standpoint cannot be overestimated, as a special congress has been appointed to look after the former, while as to the latter it is beyond doubt that the practical result of the Exposition will be to increase the prosperity of the Trans-Mississippi States by prominently bringing their products to the notice of the other States of the Union as well as to many European and South American countries. In other words, this Exposition should do for the Trans-Mississippi States what the New Orleans, Atlanta and Louisville Expositions did for the Southern States, and what the Columbian Exposition did for the States of the middle West.

Under the Searchlight.

Notes and Comments on Various Topics.

How the Preferred Stockholders Now Look At It.

The Boston *News Bureau* of July 19 says:

A preferred stockholder of the General Electric Company who objects to the acceptance of the plan recommended by the directors for the adjustment of the capital impairment question, says that by the adoption of the 60 per cent. reduction plan, preferred stockholders' dividends to the amount of $119,056 per annum are transferred to the common stockholders. He arrives at his figures in this way:

7 per cent. dividends on present outstanding pfd. ($1,252,000)	$297,640
7 per cent. on pfd. stock reduced to 6 per cent. ($2,551,200)	178,584
Diverted dividends	$119,056

Charles Barrett, in *New York Stockholder*, says: "The preferred stockholders are called upon to actually surrender 40 per cent. of their interest. The common stockholders surrender practically nothing. Their proportionate interest in the property and earnings of the company remains unchanged while its value is increased by the amount surrendered by the preferred stockholders.

"The right of the preferred stockholders to 7 per cent. cumulative dividends in priority to any dividends on the common stock is an individual right attaching to the stock under a contract recognized by the company and executed up to July 1, 1893. The obligations of the contract cannot be impaired, nor in any way affected by action of the corporation, taken in the only way in which a corporation can act—to wit, by vote of a duly called meeting of stockholders. Were it otherwise, the company might vote to reduce the preferred stock 100 per cent. and so get rid of it altogether; and if it had any troublesome income bonds it might dispose of them by the same process."

We are glad to see that the stand ELECTRICITY has all along taken regarding the proposed adjustment of the capital impairment of the General Electric Company is beginning to bear fruit, and the preferred stockholders are realizing that the plan suggested throws the whole burden of the readjustment upon them and leaves the common shareholders if anything better off than before. As we have repeatedly reiterated, were we a preferred stockholder we should strenuously object to the plan suggested.

* * *

The Electric Belt.

O where is the genius that promised so glibly
  To place round the earth an electrical belt,
And thus turn the globe at his pleasure? Where is he,
  In these days when humanity's ready to melt?

The belt, is it ready to turn at our pleasure?
  If so give a twist, or a button press, pray,
And give us a swing into cold, polar regions,
  Not forever, but simply an hour or two, say.

In this age Electric, with wonders about us,
  Why, why should we swelter and suffer with heat?
O, why in the world don't those bright electricians
  Bring the scheme to a head and the circle complete?

The Government, mayhap, might give them the contract
  To furnish the weather—a trust might control—
When cold they could give us a turn toward the tropics,
  When hot give excursions free up to the pole.

Cohoes, N. Y. FRANCES V. HUBBARD.

* * *

THE Boston *Commercial Bulletin*, in some comments upon the circular issued by the directors of the General Electric Company, says: "The noteworthy feature of the document, however, is the cool manner in which it is acknowledged that the General Electric Company has been carrying its patent valuation at twice its value on the books all these years. If the patent account is admitted to be excessive and can be arbitrarily cut down 50 per cent., how can stockholders tell whether the actual value is worth even a million? This is one of the evils of corporation bookkeeping. These items, as patents, franchises, etc., are given any valuation that may be convenient, and when the corporation falls into trouble or hard times, stockholders wonder where the big deficit in the balance sheet came from so suddenly. Such valuations, as in this case of the General Electric, are very apt to be utterly fictitious."

* * *

IN spite of the edict forbidding the installation of electric lights or telephones in the Sultan's realm—at least so far as European Turkey is concerned—the Commander of the Faithful himself seems vastly interested in electrical matters. He also indulges in what he denies, up to the present, to his more or less faithful subjects. The Sultan's palace is magnificently lit by electricity, and the electric boat on the artificial lake in the palace garden is daily patronized by his Majesty. A paragraph in the *Electrotechnischer Anzeiger*, referring to a recent dinner at the Yildiz Kiosk, states that the Sultan asked the German Ambassador repeated questions referring to electric lighting, and that he appeared particularly interested in the mode of power transmission as applied in the Lauffen-Frankfort station. Perhaps, says the *Electrical Engineer* of London, we may soon hear of Turkey being thrown open to electric enterprise, a field which should pay, as lavish expenditure for anything that glitters, and especially for anything that is new and Western into the bargain, is the main characteristic of the Oriental.

AN INSTANTANEOUS SPEED INDICATOR.

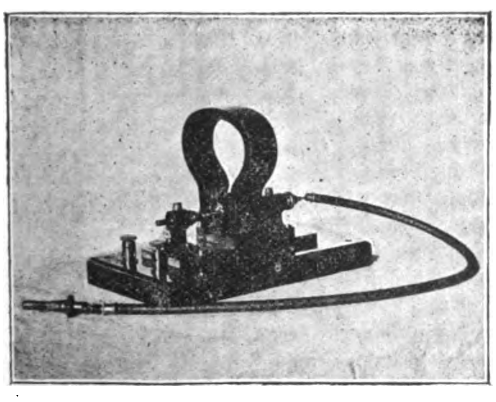
BY WM. HAND BROWNE, JR.

The following instrument, which has been used in the Electrical Engineering laboratory of the University of Nebraska to indicate speeds, has given such general satisfaction that it deserves some notice.

The instrument is, in brief, a small permanent magnet dynamo with a drum-wound armature. The field magnet is one of the standard magnets used in the Weston instruments. The armature is very carefully laminated. Flat side-bearing copper brushes are used. These permit the armature to revolve in either direction, and are adjustable around the commutator.

The armature is held in a fixed position in relation to the fields by set collars. This is necessary as any longitudinal motion of the armature would affect the readings. The instrument is used in connection with a high resistance voltmeter, and is driven directly through a flexible shaft by the machine whose speed it is desired to measure. Since the field is constant and there is little or no armature reaction, if the brushes are properly set, the EMF. generated will be directly proportional to the speed.

The instrument is herewith illustrated. Clamped to the end of the spindle will be seen the flexible dentist shaft which drives the armature. This is



sufficiently long to remove the indicator from the influence of the fields of the machine under test.

At the other end of the shaft is the coupling for attaching to the driving shaft. This is a split pin, roughened on the sides, and is simply pushed into a hole drilled in the end of the shaft. This simple device prevents all slipping and can be attached or removed while the driving shaft is in motion. The only preparation needed for the use of the indicator is the drilling of a five-sixteenths inch hole in the end of this shaft.

In determining the speed characteristic curve, a shunt motor, having a heavy fly-wheel, was driven from storage batteries to minimize the effect on the speed of fluctuations in EMF. This motor drove through a round belt and grooved pulleys the indicator, which was itself directly connected to a chronograph. Then by varying the applied EMF. any desired speed could be obtained. There was a slight drop at the upper end of this curve as the brushes were not exactly in the correct position. When this is secured, the brushes can be clamped and the characteristic is practically a straight line whether the armature revolves right-handedly or left-handedly.

By using a voltmeter having the proper amount of resistance, the indicator becomes direct reading. Otherwise the readings in volts are multiplied by a constant to ascertain the speed. The voltmeter used has a 15 volt scale and can be read to one-tenth of a division, or one revolution in 1,500.

This instrument has been in constant use for the past nine months. It is not affected by the proximity of large masses of iron. Neither the commutator nor brushes show any appreciable wear. The armature is quite cool after running steadily for two or three hours. The bearings are large and self-oiling and require no attention whatever. The whole workmanship and finish of the machine is excellent, and fully up to the high standard of the Weston Electrical Instrument Company, by whom it was made for Prof. R. B. Owens. It has proved to be one of the most valuable additions to our laboratory, and we propose adding several more to our equipment next year.

SWITCHBOARD APPARATUS.*

BY J. R. BLAIKIE,

Chief Assistant Electrical Engineer, Bristol, Eng.

The control and measurement of electric energy is one of the most fascinating details of this branch of engineering.

The switchboard, with its glittering array of polished metal and graduated dials, has always an attraction for the lay mind, while its intricacy or beautiful simplicity is a source of wonder or poetic appreciation to those better acquainted with such devices.

Almost every station has some noticeable peculiarity with regard to its switch gear, and there are few stations that have not lived to see radical changes brought about in this portion of the original scheme. The result at the present time is, that it is almost impossible to classify the types now in use. This striking non-conformity, although intensely interesting, is not particularly happy, since it appears to show either ignorance or vanity on the part of the designers.

One must admit that the spirit of commercial industry is to suppress varieties in favor of a standard. It would be ridiculous to suppose that the mere straining after novelties has been the whole cause of the present multifarious assortment. Switchboards have been conscientiously designed and constructed to suit individual cases, simply because there was no general standard that might be adopted. After certain results and experiments, modifications and improvements have been gradually introduced. But this form of private research work is too frequently misguided and uneconomical. The experimenter cannot, as a rule, afford to test a portion of his work to destruction, so long as it answers his immediate purpose he is satisfied.

A certain elegance of variety and some treasures of ingenuity must be sacrificed to further the march of scientific progress. One must be content to labor in a vast organization and strive towards a higher ideal than a more or less original switchboard. It is hard for a young enthusiast to surrender an opportunity for displaying a capacity for design in a field of such unlimited possibilities. It is far easier for him to imagine that there are peculiar necessities and requirements in the case under consideration, but seeing that there are life risks, and that the very heart of the undertaking lies in the switchboard, surely it should be the outcome of the strongest possible combination of experience, and beyond the reach of individual fancy.

Before dealing with the disposition of the component parts of the switch gear, it might be well to inquire into the duties and characteristics of the details.

The necessity for ever breaking a circuit while carrying much energy is not universally granted. For example, Prof. Forbes in his paper on "The Electrical Transmission of Power from Niagara Falls," November 9, 1893, says: "I hold that it is a piece of culpable ignorance, ruinous to the machinery, if anyone should ever on a large power circuit with alternating current suddenly break the circuit while current is passing. The practice is quite unnecessary and has given rise to a large proportion of the breakdowns of alternating current machinery." Nevertheless there are switches at Niagara (see *Cassier's Magazine*, page 291, Niagara number) capable of breaking 5,000 horse power without damage to themselves, etc. Prof. Fleeming agrees with Prof. Forbes, but he asks what happens if the circuit opens itself, and what is to be done about fuses. Unfortunately Prof. Forbes omits these points in his reply.

In practice, of course, one never opens a circuit conveying much energy unless some unforeseen circumstance throws the whole or a portion of the machinery out of the usual control. Could not such emergencies be met by inserting a moderate amount of resistance or impedance in the circuit, increasing either by degrees if necessary? The same might apply to cut-outs when they are under the observation of an attendant. In the author's opinion main switches should work through steps in this manner, making it impossible to make or break with large currents.

Assuming, as is customary, however, that a sudden break is necessary, or that the switch is in such a form that a sudden break could be made by a mistake or accident, on the part of the attendant, while transmitting a large amount of energy, the essential characteristics of the design appear to be as follows:

1. That there shall be no danger to the operator, either by electric shock or from particles of molten metal flying free, this latter to apply to adjacent apparatus as well.
2. That there shall be no maintained arc.
3. That the contacts shall not be burnt or injured in such a manner as to prevent the efficient working of the switch on closing again.
4. That the contacts and current carrying portions of the switch shall always be in such condition that no heating will occur while carrying the maximum current for an indefinite period.

With reference to the first condition there are several well known satisfactory examples. The plug form having a large insulating handle and shield, the breaks being in earthenware pots, gives a pretty certain immunity from danger. A sufficiently long handle or mechanism actuated by cords can be considered safe.

Another method is to mount a plate-glass screen between the operator and the breaking contacts, but this does not protect the other apparatus.

To secure a certainty of break many contrivances have been devised. The simplest means is a sufficiently long air gap in the circuit.

For the sake of eliciting the opinions of the gentlemen assembled, some breaks (total length) for various conditions are suggested, assuming that the breaks are made with considerable and uniform rapidity:

Amperes.	100 to 300 volts alternating or continuous.	500 to 1,000 volts continuous.	2,000 volts alternating.
5	3/4"	4"	4"
25	1"	6"	6"
50	1 1/2"	8"	10"
75	1 3/4"	10"	12"
100	2"	12"	13"
150	3"	12 1/2"	14"
200	4"	13"	15"
300	5"	14"	16"
400	6"	15"	18"
500	7"	16"	20"

(When these breaks are in the tubes, and so protected from air currents, it might be well to add, say 50 per cent. to the length of the gap, and the same if the breaks are in a vertical direction.)

The air gap may be in one line, but in order to save space and insure a rapid break, it is more frequent to have several breaks made simultaneously in a circuit. It is not safe, however, to draw out two or more arcs, close together in air, without a substantial fireproof insulator between, as a slight current of air will blow them together and thus defeat the action of the switch.

The plug switch becomes rather too cumbrous in large sizes since the sockets must be very deep or the plugs must be spaced out considerably.

One very happy solution is the use of an [electro

* Read before the Municipal Electrical Association, London, June, 1898.

magnet in the main circuit to blow out the arc when it is formed. Another effective, though perhaps rather complicated means, is the application of a shutter, or clapper, which flies through the path of the arc and blows it out with the air currents set up. Some other designs cause the circuit to be broken under water, or an insulating oil, but to the author this appears to be a last extremity as there are obvious objections to the use of a liquid.

To satisfy the third condition, "that the contacts shall not be burnt, etc.," is a comparatively simple matter. The rate of breaking is a primary consideration, though it may not apply so forcibly in the case of the alternating currents. The use of springs or the multiplicity of simultaneous breaks suggests itself at once. A liberal weight of metal, or the proximity of a good heat conducting fireproof insulator, reduces the temperature of the arcing points somewhat. As an extra precaution, the blades are usually made of wedge shape, and plugs are tapered, so that they may clear themselves more or less on returning by shearing off the small globules of metal left on the contact faces. It is therefore desirable that the mechanism should be able to withstand such strains, and so proportional that sufficient force can be applied. Another way of overcoming this difficulty is to provide auxiliary contacts which break just after the main contacts, and so carry the arc. These contacts may be merely butting surfaces, which are not much the worse for being burnt or provided with easily renewable faces, or some material having a high melting or volatilizing point, such as carbon.

The degree in which the various switches on the market meet this requirement is readily seen.

The current carrying capacity of the contacts is of the greatest importance, since a defective contact deteriorates at a sort of compound interest law. Taper plugs and spring jaws almost invariably share this responsibility. When one reflects that trouble from this source may loosen the whole contact from the board, by destroying an ebonite bush, melt the solder from a sweating thimble and allow a cable to fall, or even render the handle of the switch useless or unsafe, there is enough material for serious thought. In addition to this there is not a very far remote chance of fire. Possibly there may have been few accidents up to the present time from this cause, owing to the newness of the apparatus, or from the fact that many switches are not working up to their full capacity. Certainly in point of design this is one of the weakest features. In some nstances, the spring in cast brass and copper, without any means of adjustment for wear, is all that can be relied upon. In the case of four plugs rigidly fixed to a handle there are instances where they are supposed to go tight home into four *fixed* conical sockets. There are a few relics of the dark ages, when current was allowed to pass through the hinge or pivot of a switch. Of course there are contacts of the laminated type, built up of hard drawn or hammered copper, which are admirably suited to their purpose. As a general conclusion, under this heading, it appears that it is advantageous to have few, preferably only one, breaking contacts in a circuit, which can easily be arranged by means of flexible connections. This arrangement gives the operator an opportunity of feeling the condition of the spring contact while forcing the switch home.

It has occurred to the author with reference to this subject, that there might be a useful application of a well known invention, of a paint which changes color on heating.

The merits and risks of automatic apparatus open a very wide question. Where springs are employed they should only be strained through a small part of their range, and carefully secured from all possible chances of getting heated, either by current passing through them, or by conduction or radiation from other sources. There should also be some provision for retaining the spring, or parts of it, should it happen to break. A single speck of rust on a steel spring will sometimes cause it to break, but the reliability of such springs as are used in watches and rifle locks may be urged in favor of their use when thoughtfully applied. Weights released by triggers and catches are frequently used with success, but the inertia may sometimes be a drawback. Special attention should be paid to hinges, etc., in such apparatus, since a slight defect may alter the adjustment or foul the whole mechanism. In switch work, it is quite common to have brass working on brass both of the same composition; this is sure to cut and bind in time. When it comes to talking of an automatic appliance that does not work, adjectives fail. Another point sometimes neglected is the provision of suitable buffers or arrangements for taking up the mechanical shock or jar. Unfortunately nearly all insulating materials are mechanically weak, so they should never be subjected to rough usage. In most cases these switches are set by hand and can therefore have strong reliable contacts. Where they have to be operated at a distance by means of a small current, the contacts are a serious trouble. An accumulation of small impulses can be used or the much abused mercury cups have to do duty. There are details in mercury cups however which make all the difference. The cups should be of iron, nickel-plated, the copper fork should also be nickel-plated and be shaped to cause as little splashing as possible.

For large currents and high voltages a multiplicity of breaks should be employed, so that a comparatively low speed will be sufficient. The author has had under his notice a switch for 15 amperes, 100 volts, in daily use for about three years. Three others, one for 15 amperes, 200 volts, the other two from 8 to 15 amperes, 100 volts, for 18 months. All these switches have given complete satisfaction and up to the present time have required absolutely no attention.

Switches requiring a shunt coil permanently in circuit are generally looked at askance, not for the sake of the coal here represented (though one does sometimes hear about the fuel consumed by a voltmeter), but mainly because the shunt coil has been known to break down.

If it were recognized that a coil will not stand unlimited cooking at say 150° F., that it is subjected to high pressure strains due to induction at times, and that in the case of alternating currents the wires must be specially supported and secured to resist the tendency to vibrate, then perhaps a coil could be made worthy of the occasion. What may be good enough for a single arc lamp is not good enough to bear the reputation of a central station.

So much for main switches. Plug connections have some point in common, though the problem is very much simpler. A taper plug between two blocks of metal, although almost universal for laboratory instruments, is rarely if ever used on a switchboard. A spring clip made to sandwich two projecting tongues is sometimes used, but the most usual form is a screw plug to connect bars on the back and front of a slate panel. Another form connects a back and front board by pushing a parallel plug through spring contacts. Ample weight of metal will in most cases make a sound connection since there is nothing to impair the original fit.

For very heavy currents, perhaps, in the case of screw plugs it may be well to have a spanner appliance instead of the ordinary fluted handle. The fire risks should also be considered in the event of a plug being taken out by accident while carrying a current. Facilities for replacing a portion of the bars damaged in this way would be advantageous.

Fuses, although so simple in conception, are often one of the most troublesome details. For low tension circuits certainly the problem seems elementary, yet there are cases where links of copper as large as the mains have been substituted for fusible metal.

There is a difference of opinion as to the most suitable metal for a fuse. Tin, lead and copper are generally employed. Then comes the question as to whether a thin strip, a single wire, a number of single wires stretched parallel to each other, or a number of small wires twisted together, makes the most reliable fuse.

The purity of the metal is also of great consequence. In designing a fuse the objects in view are:

1. Safety to attendants and adjacent instruments from molten metal or splintered insulating material.
2. A positive break in the circuit when the fuse does melt.
3. An accurate knowledge of the capacity under the condition of its mounting.
4. Durability.
5. A safe, simple and rapid means of replacing.
6. Mechanical strength, rendering it independent of skilled or specially careful handling.
7. Protection from other sources of heat, from imperfect contacts, etc.
8. Compactness.

Taking a few common examples they are mostly defective in one or two points.

The tin strip reduced in section at the center is generally suitable for low tension work, but it is almost invariably unprotected, and frequently in such a position that it will blow right in an attendant's face if he should happen to close a switch on a "short-circuit."

This type is the most durable and the most accurately gauged, but if a large range of sizes is required it is a nuisance to have to keep so many spares, especially as they are usually of a particular pattern. A rapid replacement is managed by throwing over a link or inserting a plug to connect another fuse already mounted. Otherwise it is satisfactory.

For high tension work, there are quite a lot of examples that will not break the circuit in case of a sudden "short circuit." Copper wire is generally most successful, since there is a less quantity of vaporized metal left in the path of the arc. In very small sizes, however, it is difficult to manipulate. Running in its normal condition at a high temperature it deteriorates rapidly. Again, with a variety of fittings and mountings, the value for any particular gauge alters considerably. Where the balance is held in favor of copper, there should always be an easy means of inspection at any time; either a transparent shield should be used, or a duplicate system employed, which will allow a fuse to be removed and examined without interrupting the supply. One well-known fuse consists of a length of wire soldered at either end to plugs having ebonite handles. The mechanical weakness of this arrangement may lead to serious accident. The operator gets one plug in, then perhaps breaks the wire and the live end sags down and touches his hand. Besides this, there is the inconvenience of having to solder the wire to the plugs. Another has a wire fitted into a gauge glass, sealed at the ends and half full of a liquid; these have been known to explode with great violence. Let us hope that they have long since joined the ranks of "our old type."

A lead wire incased in an india-rubber tube, or a copper wire in an asbestos sheath, has been used with success as far as the break goes; a wire in a glass or earthenware tube with the ends open is reliable if of sufficient length. One of the most recent designs has many novel features. The holder is in the form of a drawer made of earthenware, having a partition down the middle lengthwise. The fuse is a short length of wire, strained over the partition by means of two springs, the current being conveyed through flexible conductors, from two wedged contact pieces projecting from the back end of the drawer. When in use the drawer is filled with a special oil and pushed home, so that the wedges enter spring jaws. When the fuse wire melts the springs carry the ends down under the oil and so extinguish the arc. The makers claim that with

this fuse 500 amperes at 2,000 volts can be broken without any hitch.

The percentage of error in adjustment must be rather large, since it would take some time to warm up a large mass of earthenware and oil, and again, the unknown tension of the spring introduces another source of error. The fuses are arranged in duplicate for inspection and rapid replacement and are extremely compact.

(To be continued.)

THE PROTECTION OF STEAM HEATED SURFACES.*

BY C. L. NORTON,

Boston, Mass.

The investigation, of which this is a partial report, has been undertaken at the request of Mr. Edward Atkinson and has been pursued during a large part of the years 1896 and 1897, and is yet uncompleted. The first object sought for was the relative efficiency of several kinds of steam pipe covering now upon the market. The second object was to ascertain the fire risk attendant upon the use of certain methods and materials used for insulation of steam pipes. Third, an attempt was made to show the gain in economy attendant upon the increase of thickness of coverings, and to show also the exact financial return which may be expected from a given outlay for covering steam pipes. Further information is given on many minor matters and conditions affecting the transfer of heat from a steam pipe to the surrounding air.

METHOD.

The method adopted is one which, so far as I know, is original. A piece of steam pipe is heated from the inside electrically. The amount of electrical energy supplied is measured, and hence the amount of heat furnished is known. If the steam pipe is kept at a constant temperature by a given amount of heat it is because that amount is just equal to the heat it is losing, for if the supply were not equal to the loss the temperature would rise or fall. In other words, the heat put into the pipe is just equal to the heat lost from it by radiation, convection and conduction. By measuring the electrical energy supplied I can determine the heat put in, and hence the heat given out or lost. It must be borne in mind that a given amount of electrical energy always produces the same definite amount of heat, the amount of heat furnished by one electrical unit of energy being known with greater accuracy than the amount of heat given out by a pound of steam in condensing.

APPARATUS.

The apparatus for making tests by this method comprises several pieces of steam pipe of different diameters and lengths, heated electrically from within by means of coils of wire in oil. The oil is stirred vigorously and serves as a very efficient carrier of heat from the wires to the pipes. A brief description of the smallest tester may make the details of the apparatus more easily understood.

A piece of 4-inch steam pipe, 18 inches long, is closed at one end by a plate welded in, and at the other by a tightly fitting cover. This pipe is then filled with cylinder oil, and a coil of wire of sufficient carrying capacity and a stirrer are introduced into the oil. A thermometer is inserted in such a position as to record the temperature of the oil. An ammeter and voltmeter or a wattmeter may then be connected so as to record the amount of electrical energy supplied. The stirring must be brisk, and if enough power is put into the stirrer to be comparable with the electrical energy supplied, such amount must, of course, be added, as it also is converted into heat. It is my custom to suspend the apparatus in the middle of the room on non-conducting cords, and read the thermometer with a telescope, so that no heat from the person of the observer may be added to the supply given to the cover from within, and also that care may be taken not to produce air currents by walking near the apparatus during a test.

PROCEDURE.

In making a test the following operations are carried out, and observations are taken in the following order:

The current is turned on, and heat is generated in the wire coil until the wire, oil and steam pipe have reached the desired temperature at which it is proposed to test. The current is then gradually diminished until it is found to be of just the amount necessary to keep the pipe at this temperature without a rise or fall of $\frac{1}{10}$ of a degree in 30 minutes. A reading of the voltage and current is now taken at intervals of 30 seconds, and the watts and B. T. U. are computed from their average. We then have the number of B. T. U. lost from the outside of this particular pipe at this particular temperature. If now we place a steam pipe cover around the pipe, we shall find that a less amount of energy is sufficient to keep it at the required temperature, the difference being the amount of heat saved by the covering. The minimum length of time considered sufficient for the equalization of heat, or "soaking in" to the cover is six hours. If after a second heating of six hours no change in the conducting power is noted, the cover is considered in a permanent condition and is tested. Some covers, notably those composed wholly or in part of wool, cannot be considered dry and constant until after an exposure upon a pipe at 200 pounds pressure for six or eight days. Covers containing sulphate of lime are also slow in drying.

The three thermometers used were frequently standardized in naphthaline, and were examined to note any disagreement among themselves.

A discussion of the position of the tester and its exposure to air currents will be found in a later paragraph.

RESULTS.

A comparative test was made in 1895, upon a number of steam pipe covers on a 4-inch tester 16 inches long. The results obtained have been published in the circulars issued by the Boston Manufacturers' Mutual Fire Insurance Company and by the Steam Users' Association. The values were stated to be purely *relative*, the specimen being too small to give reliable data on the *absolute* conduction, and the surrounding conditions not being controlled other than to maintain them constant during the several runs. The ends of the specimen were covered by massive heads and the whole tester was situated within a few inches of a brick wall and a stone pier. It was called to my attention that the heat loss was probably high, and I agree that the exposure was such as to make it so, being a rather harsh test, but one which was rigidly uniform in its requirements of the several covers. In short, the actual loss of heat per square foot of the pipe surface was correct for that particular piece under the conditions of the test, but was not sufficient for the estimation of the actual saving which might be expected from the general use of coverings. I deemed it wise, therefore, to construct new heaters, four and ten inches in diameter and thirty-six inches long. These were suspended by non-conducting cords in the center of the laboratory, so as to hang freely and not be in contact with any conducting supports. Conduction up the lead wires and stirring rod was found to be negligible.

It seems to me that I have approached more nearly the conditions of actual practice than can be obtained by any other method of testing, except the actual use of a long run of pipe; and the determination of the amount of heat put into such a pipe by the "condensation" method offers many difficulties and is open to much uncertainty. I feel, therefore, that in adopting this method I am using a reasonable exposure for the pipe, and have an exceptionally good opportunity to measure the heat supplied.

Table I gives the relative conductivity of the various kinds of steam pipe cover tested up to April, 1898.

TABLE I.

Specimen.	Name.	B.T.U. loss per sq. ft. pipe surface per minute.	Ratio of loss to loss from bare pipe.	Thickness in inches.	Weight in ounces per ft. of length 4 in. diameter.
A	Nonpareil cork standard	2.20	15.9	1.00	27
B	Nonpareil cork octagonal	2.38	17.2	.80	16
C	Manville high pressure	2.38	17.2	1.25	54
D	Magnesia	2.45	17.7	1.12	35
E	Imperial asbestos	2.49	18.0	1.12	45
F	W. B.	2.62	18.9	1.12	59
G	Asbestos air cell	2.77	20.0	1.12	35
H	Manville infusorial earth	2.80	20.2	1.50	...
I	Manville low pressure	2.87	20.7	1.25	..
J	Manville magnesia asbestos	2.88	20.8	1.50	65
K	Magnabestos	2.91	21.0	1.12	48
L	Molded sectional	3.00	21.7	1.12	41
M	Marsden infusorial earth	3.11	22.5	1.00	50
N	" " "	3.27	23.7	1.00	43
O	Asbestos fire board	3.33	24.1	1.12	85
P	Calcite	3.61	26.1	1.12	66
	Bare pipe	18.84	100.	..	..

It gives the results of the tests upon most of the samples tested, some being omitted when found to be of such low efficiency as to be of doubtful value.

Specimen A consists of granulated cork pressed in a mold at high temperature, and then submitted to a fire-proofing process.

Specimen B is similar in composition, but is made up of several strips of cork instead of two semi-cylindrical sections.

Specimen C is a sectional cover composed of an inner jacket of earthy material and an outer jacket of wool felt, the whole being one and one-quarter inches thick.

Specimen D is a molded sectional cover composed of about 90 per cent. carbonate of magnesia.

Specimen E is essentially an air cell cover, being composed of sheets of asbestos paper which have been indented before being laid up, the indentations serving to keep the thin sheets of paper from coming in close contact with one another, thereby causing a considerable amount of air to be held throughout the body of the cover.

Specimen F is composed of a wool felt with a lining of asbestos paper.

Specimen G is a cover made up of thin sheets of asbestos paper fluted or corrugated and stuck together with silicate of soda.

Specimen H is a plastic covering made of infusorial earth.

Specimen I is a low pressure covering similar to Specimen F.

Specimen J is a plastic cover, and called by the makers magnesia-asbestos. It contains only a slight amount of carbonate of magnesia.

* Paper presented at the Niagara Falls meeting (June, 1898,) of the American Society of Mechanical Engineers.

Specimen K—The magnabestos is a molded cover, containing about 45 per cent. of carbonate of magnesia and a considerable percentage of carbonate of lime.

Specimen L is composed mainly of sulphate of lime and some 20 per cent. of carbonate of magnesia, and has upon its outer surface a thick sheet of felt board.

Specimen M is a sectional molded cover. It is composed largely of infusorial earth from California.

Specimen N is similar to Specimen M, except that to its composition has been added some 45 per cent. of carbonate of magnesia.

Specimen O is similar to Specimen G, except that it has larger cells and contains much more silicate of soda. It is very hard and strong.

Specimen P is a sectional molded cover, composed mainly of sulphate of calcium. It has an outer layer of felt board.

In regard to the compositions of Specimens C, J, L and P, I desire to state that I have made no complete analysis, but I have satisfied myself that the principal ingredient is sulphate of calcium and *not* carbonate of magnesia. Prospective purchasers of pipe covers should not be misled by names. Since the appearance of Prof. Ordway's reports, it has been recognized that carbonate of magnesia was of great value as a non-conductor of heat, hence the name "Magnesia" has been applied to a great many covers. It is to be observed that there is no virtue in a name. Asbestos is merely an incombustible material in which air may be entrapped, but when not porous is a good conductor of heat. Magnesia is a most effective non-conductor. This name has been applied to many compounds of which the greater part consist of carbonate of lime, or plaster of Paris, materials which are not good as a heat retardent. The percentage of magnesia carbonate and plaster of Paris in several molded sectional covers is given in Table II.

TABLE II.

Specimen.	Percentage Composition.	
	$MgCO_3$.	$CaSO_4$.
D	80 to 90	3
C	less than 5	65 to 75
L	20 to 25	20 to 60
P	less than 5	75
J	10 to 15	none.

I have made no investigation of the effect of the raw materials upon the metal of the pipe, other than to satisfy myself that the cork, magnesia, air cell and Imperial covers cause no corrosion.

The conditions of testing were such as I have adopted as being reasonably near the conditions of actual practice. The room temperature was kept at 72 degrees Fahrenheit, and the openings into the room were carefully closed. It was found early in the series that variation in the amount of moisture present in the air altered the amount of heat lost from the covers, but no attempt was made to correct for this. The error introduced is not greater than one per cent.

It was found that the heat loss per square inch of the flat surfaces at the ends of the pipes was less by several per cent. than the loss from the sharply curved sides, and as all pipe covers tested were used to cover both sides and ends, the figures given in the table show a loss less than would be shown were the pipe surface wholly cylindrical, and more than if it were all flat.

The pipes were suspended from the ceiling, as described in an early paragraph, and the air circulating about them was due only to their own convection currents. The variation in thickness in different places on the same specimen was considerable, but an average of twenty measurements was taken and results given in the table to the nearest one-eighth of an inch. Owing to these variations in thickness, the results of a measurement of the efficiency of any one cover cannot be used to predict the efficiency of a second cover of the same make with an accuracy greater than two per cent. Two specimens of each make were tested, and in some cases four, the mean value being given in the table.

Table III gives the saving, in dollars, due to the use of the various covers.

TABLE III.

Specimen.	Name.	Loss B. T. U. 200 lbs.	Saving B. T. U.	Saving per year per 100 sq. ft.
A	Nonpareil cork standard	2.20	11.61	$37.80
B	Nonpareil cork octagonal	2.38	11.46	37.20
C	Manville sectional, H. P.	2.38	11.46	37.20
D	Magnesia	2.45	11.39	36.90
E	Imperial asbestos	2.49	11.35	36.80
F	"W. B."	2.62	11.22	36.40
G	Asbestos air cell	2.77	11.07	36.00
H	Manville infusorial earth	2.80	11.04	35.85
I	Manville low pressure	2.87	10.97	35.65
J	Manville magnesia asbestos	2.88	10.96	35.60
K	Magnabestos	2.91	10.93	35.50
L	Molded sectional	3.00	10.84	35.20
M	Marsden No. 2	3.11	10.73	34.85
N	Marsden No. 1	3.27	10.57	34.60
O	Asbestos fire board	3.33	10.51	34.20
P	Calcite	3.61	10.23	33.24
	Bare pipe	13.84	0.00	

Table IV shows that at the end of ten years the best of the covers tested will have saved $46 more than the poorest. The difference between the several covers of the better grade is exceedingly small.

TABLE IV.

Net Saving per 100 Square Feet.

Specimen.	Name.	1 year.	2 years.	5 years.	10 years.
A	Nonpareil cork standard	$12.80	$50.60	$161.00	$353.00
B	Nonpareil cork octagonal	12.20	49.10	161.00	347.00
C	Manville sectional high pressure	12.20	49.40	161.00	3 7.00
D	Magnesia	11.90	48.80	159.50	844.00
E	Imperial asbestos	11.80	48.60	159.00	843.00
F	"W. B."	11.40	47.80	157.00	339.00
G	Asbestos air cell	11.00	47.00	155.00	335.00
H	Manville infusorial earth	10.85	46.70	154.25	333.00
I	Manville low pressure	10.65	46.30	153.75	331.00
J	Manville magnesia asbestos	10.60	46.20	153.20	331.00
K	Magnabestos	10.50	46.00	152.50	330.00
L	Watson's molded sectional	10.20	45.40	151.00	327.00
M	Marsden No. 2	9.85	44.70	149.20	823.00
N	Marsden No. 1	9.60	44.20	148.00	321.00
O	Asbestos fire board	9.20	43.10	146.00	317.00
P	Calcite	8.24	41.48	141.20	307.00
	Bare pipe	......	....	......	......

The money saving is computed on the following assumptions: Coal at $4 a ton evaporates ten pounds of water per pound of coal. The pipes are kept hot ten hours a day three hundred and ten days a year. If computations are made, as is sometimes done, on an assumption that the pipes are hot twenty-four hours a day three hundred and sixty-five days in a year, the saving is nearly three times that shown in Table III.

Generally speaking a cover saves heat enough to pay for itself in a little less than a year at 310 ten-hour days, and in about four months at 365 twenty-four-hour days.

It is evident that the decision as to the choice of cover must come from other considerations as well as from the conductivity.

The question of the ability of a pipe cover to withstand the action of heat for a prolonged period without being destroyed or rendered less efficient is of vital importance. The increasing use of cork as an insulator has led to many questions as to its ability to remain "fire-proof." I have exposed it to a temperature corresponding to 350 pounds of steam for three months, and to a temperature corresponding to 100 pounds for two years, and can detect no change, and I am satisfied, as well as one can be without the actual experience, that any suspicion of its ability to withstand continued heating is groundless.

The magnesia covering is, of course, unquestionable on this ground, being almost indestructible by heating.

The Imperial asbestos is also perfectly safe from any fire risks, as is the air-cell and fire board.

The Manville and Marsden infusorial earth and also the Manville asbestos-magnesia are liable to no accident from fire, nor is the Carey calcite.

It is to those covers, the "W. B." of the Watson Company, and the Manville sectional and others which possess a composite structure that I desire to call attention. I do not consider it safe to put upon a steam pipe wool, hair, felt or woolen felt in any form. The causes of risk are two: First, the wool may become charred by heat from the pipe and finally ignited. However, this can hardly happen, even on high pressure pipes, when the thickness of fire-proof material, asbestos, magnesia, or whatever it may be, is of as great a thickness as one inch. The second and most serious risk is from the presence in shops or mills of the long tubes of wool, dry as tinder, often connecting one room with another, and ready to flash at the slightest rise in the already too great temperature. I would even insist that the canvas jackets on the covers be fire-proof. An accident in my own laboratory has proved the actual danger of these wool felts, and I should not be willing to allow their use again. Their efficiency is high as non-conductors, but not higher than any other perfectly safe covers. If the wool is separated by about one inch of fire-proof material from the pipe it is not kept so hot and dry, and the risk from outside ignition is less, but I do not endorse the practice of many engineers in wrapping hair felt outside of a sectional cover. The saving due to this practice is indicated in Table V.

The following assumptions have been made in computing the Tables IV, V and VI: First, that all the covers cost $25 per 100 square feet applied. I realize this is a high figure, perhaps too high, yet it is not far from the list price of several makers, and any attempt to get a definite price from them revealed a maze of discounts and double discounts and flexible price lists too intricate for an uninitiated mind to unravel. In case the saving due to a cover which costs $20 instead of $25 is desired, the simple addition to the final saving of the $5 difference makes the necessary correction.

Secondly, by the advice of the makers, I have made an assumption that the cost is not nearly proportional to the thickness. As the thicker coverings are not now made in great quantities, the actual cost of their manufacture is uncertain.

Inspection of Table V shows the saving due to the use of hair felt outside a standard magnesia cover.

In five years 100 square feet of hair felt saves $7 more than its cost, and in ten years it saves $20 above its cost.

The further saving due to a second inch outside the first is $8 in ten years. Of course the well-known tendency of hair felt to deteriorate should be considered.

In the case of nonpareil cork, increasing the thickness from one to two inches raises the cost from

about $25 to $35 per 100 square feet, and increases the net saving in five years by $10 and by $30 in ten years. In other words, the second inch of material in use about pays for itself in two years, while the first pays for itself in about one year. The third inch does not increase the saving even in ten years. The second inch, therefore, more than pays for interest and depreciation, while the third fails to do this.

In the case of the asbestos fire board, a second inch in thickness causes a saving of $20 in ten years, the third and fourth inches showing a loss.

In general it may be said, therefore, that if five years is the length of life of a cover, one inch is the most economical thickness, while a cover which has a life of ten years may to advantage be made two inches thick.

In view of the custom which prevails to some extent of wrapping asbestos paper around a pipe, and surrounding the whole with hair felt, I made tests as to the temperature of the bounding line of the asbestos paper and hair felt, using a Le Chatilier thermo-electric pyrometer for this purpose. The different samples of asbestos paper give widely varying results, but a general idea of the protection offered by the paper may be had from Table VI.

TABLE VI.

Protection Afforded by Asbestos Paper.—Pipe at 200 Pounds Pressure.

Thickness of asbestos paper.	Temperature of pipe.	Temperature of inside of hair felt.	Pressure corresponding to the temperature of the inside of the hair felt.
1/64 inch.	384.7° Fahr.	356° Fahr.	146 pounds.
1/32 "	385.0° "	329° "	102 "
1/16 "	384.6° "	302° "	70 "
1/8 "	384.7° "	266° "	39 "

I have had my attention called to the varying loss from bare pipes when their surfaces were in varying conditions as regard rust, dirt, paint, etc. I therefore made a few brief tests to satisfy my mind as to the chance of there being any large variation which might influence my figure for the loss from bare pipe, viz., 13.84 B. T. U. per square foot per minute. The results are shown in Table VII.

TABLE VII.

Loss of Heat at 200 Pounds from Bare Pipe.

Condition of Specimen.	B. T. U. lost per sq. ft. per minute.
New Pipe	11.93
Fair condition	13 84
Rusty and black	14 20
Cleaned with caustic potash inside and out	13.85
Painted dull white	14 30
Painted glossy white	12 02
Cleaned with potash again	13.84
Coated with cylinder oil	13.90
Painted dull black	14.40
Painted glossy black	12 10

The rate of heat loss from a bare pipe is also affected by the air circulation and the temperature of the surrounding bodies. A few tests were made to indicate the magnitude of the errors likely to be caused by variation in these conditions, and a brief examination of some of the results may be interesting. They are given in Table VIII.

TABLE VIII.

Effect of Surroundings.

Condition and Position of Pipe.	B. T. U. lost per sq. ft. per minute at 200 pounds.
1. Standard condition hung in center of room	13 84
2. Near brick wall, between windows	11 26
3. Hung horizontally in center of room	12 06
4. Vertical 10 inch pipe — 36 inches long	13.18
4. Vertical 10 inch pipe — 18 inches long	11.42
5. Vertical, 18 inches long — 10 inches diameter	14.42
5. Vertical, 18 inches long — 4 inches diameter	15 20
6. 4 inches diameter in draft from electric fan	20.10

Table IX shows the varying loss from a bare pipe with the change in pressure:

TABLE IX.

Variation of Heat Loss with Pressure.

Pressure.	Bare pipe. Loss B. T. U. per sq. ft. per min.
340	15.97
200	13 84
100	8 92
80	8.04
60	7 00
40	5.74

A very thorough test was made of the common method of judging a pipe cover by the sensation of warmth given the hand on touching it, and nothing too harsh can be said of this practice. The sensation is dependent to such an extent upon the *nature of the surface* that it fails utterly to give any idea of the actual temperature. I have been unable to devise any method of so attaching a mercury thermometer to the outside of a steam-pipe cover as to make use of it as a testing device in measuring heat loss.

TABLE V.

Variations in Thickness, etc.

Specimen.	Saving in B.T.U. per sq. ft per minute.	Saving in dollars per 100 sq. ft. per year.	Net saving. 1 year.	2 years	5 years.	10 years	Approximate cost.
Magnesia:							
1⅜ inches thick	11.62	$37 75	$7.75	$15.50	$159	$317	$30
1⅜ inches thick and 1 inch of hair felt	12 38	40.22	5 22	15 44	166	367	35
1⅜ inches thick and 2 inches of hair felt	12 77	41.50	1.50	43 00	167	375	40
Nonpareil cork:							
1 inch	11.64	37 80	12.80	50 60	164	353	25
2 inches	12 84	41.75	7.75	48.50	174	383	35
3 inches	12.94	42.05	7.95	34 10	160	370	50
Fire board:							
1 inch	10.54	34 20	9.20	43 40	146	317	25
2 inches	11.48	37.25	2 25	39.50	151	337	35
3 inches	11 70	88.00	12 00	26.00	140	320	50
4 inches	11 83	38.40	26.60	11 80	127	319	65

I am desirous of calling attention to the advantages arising from the use of plastic rather than sectional covers. The ease of removal for repairs or alterations makes the sectional cover better for some work, but there is much pipe surface which might be covered securely with plastic where a sectional cover is soon ruined by vibration. Of course the plastic covers offer no possibility of leaky joints and long cracks. It should be borne in mind that in most cases about 20 per cent. of the entire surface to be covered is irregular, and must be covered by plastic or fittings. It will be well for prospective purchasers of pipe cover to see to it that their contracts call for fittings and plastic of as high an efficiency as the sectional cover shows.

I am now testing a considerable number of samples of non-conducting material, not perhaps classed as pipe covers, but used for heat insulation. Table X gives some figures concerning them which may be of interest.

TABLE X.

Miscellaneous Substances.

Specimen.	B. T. U. per sq. ft. per min. at 200 lbs.	Saving in one year per 100 sq. ft. pipe.
Box A.		
1 with sand	3.18	$31 60
2 with cork, powdered	1 75	39.40
3 with cork and infusorial earth	1.90	38.90
4 with sawdust	2 15	37.90
5 with charcoal	2 00	38.50
6 with ashes	2.46	36 90
Brick wall 4 inches thick	5.18	28.80
Pine wood 1 " "	3 56	33 80
Hair felt 1 " "	2.51	36 80
Cabot's seaweed quilt	2.78	35.90
Spruce 1 inch thick	3 10	33 90
" 2 " "	2 31	37 50
" 3 " "	2.02	38 50
Oak 1 inch thick	3.65	33.10
Hard pine 1 inch thick	8.72	32.90

The box A referred to in the table is a ¼ inch pine box, large enough to surround the pipe and leave a one-inch minimum space at its four sides. In it were tested several materials which I find are used in just this way for steam and cold storage insulation.

In concluding, I desire to express my thanks to those gentlemen who have assisted me in this test, and especially to Mr. John R. Freeman, Member of the Society, for his kindly advice.

LONDON NOTES.

[From our London Correspondent.]

The Waterloo & City Electric Railway Opened.

During several years past we have briefly recorded the progress made in the construction of the underground electric railways of London, particularly the line running from a point beneath the Waterloo Station, beneath the River Thames, under the very heart of the city of London at a great depth, to a central point near the Mansion House, where it is intended that several new electric underground lines shall converge. We have now at last to record the opening of the Waterloo line, which consists of twin tunnels constructed by the aid of the celebrated Greathead shield, the length of these tunnels being about 1½ miles. There are no intermediate stations.

The work was commenced about four years ago, various difficulties in the earth work at the Mansion House end, also other causes, having led to considerable delays. The Duke of Cambridge declared the line open on Monday, July 11, in the presence of a goodly company of officials, directors, engineers, etc., and the trains will be almost immediately available for public traffic. The line is owned and operated by the Waterloo & City Railway Company, but the London & Southwestern Railway, whose terminus is at Waterloo, is understood to be very closely connected with the undertaking. The electrical equipment has been carried out by Messrs. Siemens, Bros. & Co. The generating works are situated near Waterloo, the third-rail system is employed, and the American type motor cars are fitted with gearless motors. The track is of standard gauge (4 ft. 8½ in.) At one point the tunnels are laid beneath the great sewer and the tunnels of the Metropolitan Street Railway Company. The engineers for the line were Prof. A. B. W. Kennedy (Mr. Greathead it will be remembered died while the works were in progress), and Mr. H. Dalrymple Hay was resident engineer. The Waterloo & City is the second underground "electric" for London, the other being the well known City & South London, which is rapidly extending at both ends. As the Waterloo & City is a shorter and better district from a traffic point of view, it will probably show a more favorable return upon the capital outlay during the early years of running than did the City & South London. The Central London underground line is being pushed forward for completion as early as possible.

Discovery of a New Gas.

A special cable dispatch from Paris, July 19, to the N. Y. *Sun*, states that Prof. Nasini of Padua has communicated to the French Academy the result of his investigation of the gases issuing from the earth in volcanic districts. Among them he found coronium, which has hitherto only been known hypothetically as a constituent of the sun. His investigations suggest the probability of the presence of other new elements. Coronium seems to have a vapor density far smaller than hydrogen.

The General Electric Company owed, on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

UNDERGROUND FEEDERS FOR ELECTRIC TRACTION.*

BY CHARLES E. MORRIS.

In deciding upon the method to be adopted in laying underground feeders for electric traction, the relative advantages and disadvantages have to be weighed, presented on the one hand by a system of cables drawn into ducts, and on the other by cables buried in the ground and protected by armoring or bedded in bitumen.

The choice between the "drawing-in" and the "solid" systems is a problem which has occupied engineers of electric lighting schemes since the early days of the industry. Each system has its advocates; and judging from present practice, and the divided opinion which now exists, it appears that the question is still an open one. Of late years armored cables have been extensively adopted; but time has demonstrated that under some conditions, which hitherto have not been satisfactorily defined, the metal armoring corrodes to such an extent as to be no longer any protection to the cables. This may account for what appears to be a growing tendency among those who favor a "solid" system to abandon the use of metal sheathing and to lay the cables in troughs of wood, earthenware or iron, which are then filled with a bituminous compound. The diversity of opinion among lighting engineers as to the desirability of a "drawing-in" system appears to have had reference rather to distributing cables than to feeders; the reason being, no doubt, that the advantages of a duct are seriously interfered with when T-joints have been made on the cable within. Among those who use a "solid" system for distributing cables, there are a large proportion who fully recognize the value of a "drawing-in" system for feeders; and modern town-lighting schemes present numerous instances of the use of a conduit system for feeders, in combination with a "solid" system for distributors.

A "drawing-in" system possesses obvious advantages in the facilities it affords for withdrawing a faulty length of cable and replacing it by a new length, for increasing the section of copper to meet an augmented demand for current, and, by the provision of spare ducts, for drawing in extra cables as requirements arise. Where a "solid" system is used, either of these operations would necessitate opening and replacing the pavement at considerable cost, delay and inconvenience. Even if a built-in system be adopted for the cables necessary for the initial working of a scheme, it is manifestly advantageous to provide spare ducts to meet contingencies.

Assuming that, for traction feeders, a "drawing-in" system is desirable, there arises the question as to its cost as compared with protected cables buried in the ground. The kinds of duct in use in this country are practically limited to two; viz., cast iron pipes and earthenware conduits. Of late years, in connection with electric lighting, the use of iron pipes has diminished while that of earthenware has increased. In fact, earthenware conduits have been adopted for by far the larger portion of recently executed conduit systems. The cost of these ducts is considerably less than that of iron pipes. This is apparent when only a few ducts have to be provided; and, owing to the grouping of a number of ducts in one conduit, the cost per duct is reduced, and the disparity becomes even greater. The life of earthenware is practically unlimited. It is proof against the action of gas and other chemical agents present in the soil; and, being an inert substance, there is no risk of its exerting any deleterious influence on the cables within. What it lacks in strength compared with iron, for a given sectional area, is compensated for by increase in thickness. Owing to the smooth interior surface, cables may be drawn in with small risk of damage to the insulating material. Further, the conduits are easily and rapidly laid.

A modified procedure simplifies the jointing and effects a reduction in the cost. In forming the concrete bed, it is struck off at the level at which the conduit is to be laid. A wood template or mould is employed consisting of a board with battens fixed transversely on its under side at intervals corresponding with the lengths of the section of conduit. On removal of the template a continuous recess is left, in which the lengths of conduit are laid, their ends being closely butted together. Cement grout is then poured into the cavities formed by the cross-battens, which occur at each joint. The lower part of the joint is thus readily made perfectly sound, and a man can follow on and complete the upper part with cement in a mortar-like consistency. The whole is then covered with concrete. This method of laying has the advantage of being very rapidly executed.

For traction feeders the employment of concrete in the track construction affords an opportunity of installing earthenware conduits in a very satisfactory way. Buried in concrete they are effectually protected from damage which might otherwise be caused by workmen excavating or by settlement of the ground, and when so laid they form a sound constructional job, the depreciation of which may be regarded as nil. In joining the lengths of the conduit by the usual method the ends are bedded in Portland cement upon earthenware cradles, and the upper part of the joint is completed with cement laid on with a trowel.

* The *Railway World*, London.

Motor Gears.

The gearing of two motors, says the *Electrical Review*, London, by three bevel wheels, is an exceedingly useful adaptation of an old mechanical movement. This three-bevel wheel gear has many valuable properties, for it can be applied with a sliding clutch for reversing the rotation of a shaft, and is so used on lathes; it can be used for multiplying the speed of rotation, and as a differential gear it has been applied in Dr. Aron's electricity clock meter; it can also be employed on motor cars to enable one motor to drive two wheels at different speeds. The beauty of the gear applied to two electro-motors lies in the ease with which the motors may have their speeds varied or reversed. We should think it will be of great value in applying motors to many purposes besides steering-gear for ships.

The only drawback the gear has is that it is noisy at high speeds; but this could be overcome if the intermediate wheel can be made of raw-hide leather. The gear might be found useful on cranes and machine tools driven by electro-motors, where a wide range of differential speeds is necessary. For belt driving the intermediate bevels may be carried on the belt pulley, but for wheel and pinion drives it will be necessary to have a hollow shaft in one of the motors, through which the shaft carrying the intermediate wheel can pass to carry the pinion.

New Carbon for Arc Lamps.

Strauss, says an exchange, has patented, in Russia, a new kind of carbon for arc lamps. It is formed of 90 per cent. of very pure carbon and 10 per cent. of carburet of silicium reduced to very fine powder and agglomerated with pitch. Carburet of silicium contains no volatile element, it resists oxidation more than the other substances; but it is not a conductor, therefore it has to be combined with carbon. The inventor claims that he obtains in this manner a saving in current of 25 per cent., and a light of a richer tint and greater intensity than that of ordinary arc lamps. Its duration is 360 hours, and it is hoped that it will be increased to 1,000 hours. There are not as yet any official results to confirm these claims.

THE GENERAL ELECTRIC COMPANY.

We take the following from an article which appeared in the July 23d issue of the *United States Investor*, regarding the proposed reduction in General Electric Company's preferred stock, as being practically the same view of the situation that ELECTRICITY has all along taken. It says: "The management of the General Electric Company have issued a circular to stockholders accompanying the call for the special meeting to be held August 10, which is in some particulars a remarkable document. This circular is intended to explain why the management have decided that a 40 per cent. reduction should be made in the capital stock of the company.

"It will be remembered that the last annual report showed assets of 72 per cent. of the present entire capitalization, after charging off over $752,000, including $250,000 for the construction and equipment of a new foundry and a large and important machine shop. The report also showed that the company had earned enough to pay the regular dividend of 7 per cent. on the preferred stock, and a trifle over 3 per cent. on the common.

"In the face of this showing the preferred stockholders did not feel that they were warranted in consenting to a reduction in the capitalization of over 28 per cent., especially in view of the increasing earning capacity of the company. They felt that, even with this reduction, the company would be able with the large business ahead of it to pay 6 per cent. on the common stock, as well as 7 per cent. on the preferred, after the reduction, and they were naturally unwilling to scale down their equity to such a point as would allow common stockholders to receive the balance of the surplus earnings after 7 per cent. had been distributed on the preferred. If the whole stock was scaled down 40 per cent., it is felt that, with the business now on hand and in sight, the management would be able, after paying 7 per cent. on the preferred, to pay ultimately as high as 8 or 10 per cent. on the reduced common stock. The preferred stockholders did not feel, in short, that they were justified in making such a sacrifice for the benefit of common stockholders.

"ASSETS OVER-VALUED.

"But now the management have come out with a circular in which they show that the assets of the concern really do not amount to 72 per cent. of the present entire capitalization, and for the purpose of enabling them to carry their plan through, admit that they charged up their assets on a false valuation in their annual report, although they intimated then that the figures representing the patent account were nominal, and that the question of a revaluation of patents was one to which consideration would be given at the proper time. They stated at the same time, however, that the company had secured many important patents during the year by inventions of its engineers and experts, and by purchasing others, so that the implication was at any rate that there was to be only a moderate scaling down of the patent account, certainly not such a reduction as has been made.

"The management refer to this matter in the circular in the following language:

"'Appended is the consolidated balance sheet of the company of January 31, 1898 (being the close of the last fiscal year), as it appears in the last annual report of the company. Your directors, being of the opinion that the valuation at which patents, franchises and good will were carried in this balance sheet—namely, $8,000,000—was excessive, and that the fair and reasonable value of this item is the sum of $1,000,000, have, by resolution, directed this item to be reduced to that amount upon the books of the company as of June 30, 1898. Taking into account the estimated earnings of the company to August 10, 1898, your directors believe that a reduction of the share capital of the company as of August 10, 1898, to 60 per cent. of its present amount would make the share capital of the company substantially equal to the amount of the net assets which will then be on hand over and above the debts and liabilities

of the company. Any surplus net earnings from and after that date will then be applicable to the payment of accrued dividends on the preferred stock and future dividends on both classes of stock.'

"We are not inclined to doubt that $4,000,000 more correctly represents the actual value of its patents and franchises than $8,000,000, and that it would have been decidedly better for the company if that item had been put down at the former figure in January.

"ITS PATENTS AND FRANCHISES

were worth no more then than they are now, and the management undoubtedly knew then their actual worth as well as they do now. If they had been scaled down then, the management would now be relieved from the necessity of admitting that they had charged up their assets on a false valuation. The plan suggested some time ago by the management, it will be remembered, was to scale down their capitalization 50 per cent. Probably they thought when the annual statement was prepared that a concession of 10 per cent., that is, a scaling down of 40 per cent., instead of 50, might prove acceptable to the preferred stockholders. Events have shown that they were mistaken, if they thought so."

The American Street Railway Association Convention.

At the Convention of the American Street Railway Association to be held in Boston on September 6, 7, 8 and 9, a large and attractive display of electrical exhibits is expected and the following papers will be read:

"Maintenance and Equipment of Electric Cars for Street Railways." M. S. Hopkins, Electrician Columbus (O.) Street Railway Co.

"To What Extent Should Railway Companies Engage in the Amusement Business." W. S. Holmes, General Manager Metropolitan Street Railway Company, Kansas City, Mo.

"The Carrying of United States Mail Matter on Street Railways." W. S. Dimmock, General Superintendent Omaha & Council Bluffs Railway & Bridge Co., Council Bluffs, Ia.

"The Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use." Richard McCulloch, Electrical Engineer Cass Avenue & Citizens' Railway Co, St. Louis, Mo.

"Inspection and Testing of Motors and Car Equipments by Street Railway Companies." Frederick H. Perkins, Electrical Engineer Toledo Traction Co., Toledo, O.

"Cost of Electric Power for Street Railways at Switchboard; both Steam and Water." R. W. Conant, Electrical Engineer Boston Elevated Railway Company, Boston, Mass.

The General Committee is composed of the following gentlemen: C. S. Sergeant, 101 Milk street, Boston, chairman; E. C. Foster, Lynn; J. E. Rugg, Boston; C. S. Clark, Boston; A. A. Glasier, Boston; C. Q. Richmond, North Adams; John R. Graham, Boston; Robert S. Goff, Fall River; P. L. Saltonstall, Boston; E. P. Shaw, Boston, F. H. Dewey, Worcester.

Association of Edison Illuminating Companies.

This association will hold its Fourteenth Annual Convention at Sault Ste. Marie, Mich., on September 12–14 next. The *News* of that city says: "The association will come up on the last trip of the season of either the North West or North Land. Accommodations will be reserved at the Hotel Iroquois. It is expected that about 100 delegates will be in attendance. The selection of the Soo as the place of holding the convention this year is due to the well-directed efforts of Wm. Chandler, who extended the invitation to the association at its meeting last year at Niagara Falls. Mr. Chandler left no stone unturned to favorably present the advantages offered by his home city."

LEGAL NOTES.

On the 19th inst. at Pittsburg, Pa., an appeal was taken to the Supreme Court in the case of A. R. Todd against the Second Avenue Traction Company, operating the Pleasant Valley Railway, in which a verdict for $18,250 was rendered for the plaintiff for personal injuries received at the Sandusky street crossing in Allegheny. The only other case in Pennsylvania which compares with the Todd case is that of Herbert M. Frame versus the Electric Traction Company of Philadelphia, in which a verdict for $20,000 was rendered for the plaintiff, and the Supreme Court in an exhaustive opinion sustained the verdict.

The indictment for perjury found in October last against Leslie W. Ryan on the complaint of Henry Winthrop Gray has been dismissed by Judge McMahon in Part I, General Sessions, New York. Mr. Gray wrote to Judge McMahon, stating that he wished to withdraw the complaint. The charge against Mr. Ryan grew out of a foreclosure sale in 1894 of certain properties of the Thomson-Houston Electric Company of New York, of which Gray was receiver. In his letter to Judge McMahon Mr. Gray states that Mr. Ryan employed a stenographer in dictating his letter to him, and instead of the words "paid the receiver and for the benefit of creditors $70,000," the "and" was left out. Ryan had paid $7,000, but the remaining $63,000 had been placed to the credit of the reorganization committee of the Thomson-Houston Company.

In a suit brought in Philadelphia against the Philadelphia Traction Company to recover damages for the loss of a foot by a boy who was stealing a ride, Judge Pennypacker decided in favor of the railroad. The boy became frightened at the order of the conductor, who was in the car collecting fares, and fell off while the car was in motion, a wheel cutting off his foot. The plaintiff's counsel contended that it was the duty of the conductor to stop the car and see to it that the plaintiff was put down gently and in such a way that he could not hurt himself. Judge Pennypacker in his opinion says: "Is there such a duty? We know of no Pennsylvania case which has so held, and the principle does not commend itself to approval. To hold that such a duty exists, is in effect to say that the cars are run for the benefit of trespassers. To require the stopping of a car in order to put off intruders might be upon certain occasions a great embarrassment to both the company and its passengers. The true rule would seem to be that deduced from our cases, and upon which the most of them can be reconciled, that force, or that which is tantamount to it, cannot be used to the injury of child trespassers, but that the responsibility for care over them rests with their parents and guardians."

An interesting case was decided in New Orleans a few days ago by Judge Richardson, of the First City Court, which is reported as follows in the *Picayune*: "According to the petitioner's representation, T. S. McLoughlin, an electrician, wired a house for a resident on Palmer avenue, and the agreement was that the work would be done according to the rules of the underwriters' inspection bureau. When completed the bureau inspector examined the work and refused to issue the usual certificate, saying the rules of his bureau were not observed by the electrician. McLoughlin sued for a judgment to compel the bureau to issue the certificate, and asked for $20 damages for the refusal. The trial attracted much attention in underwriting and electrical circles. Amongst the witnesses were President Bemis of the Edison Company, Col. Nelson, the manager of the Tariff Association, and a host of electrical experts. McLoughlin claimed the work was safe and according to rule and that the bureau made it a practice to discriminate against him in its issuance of certificates. He introduced in evidence an award of Hon. Alfred Raymond, city electrician, in which, after an arbitration submitted by McLoughlin and the bureau, Raymond had adjudged the bureau guilty of favoritism and discrimination against McLoughlin in eighty-four cases submitted for arbitration. McLoughlin claimed that despite this arbitration Col. Nelson and his bureau persisted in their oppression and that the present case was only another instance of it. Judge Richardson found that the National Association of Underwriters had prescribed a printed code of rules for electrical work, but he concluded that by its own acts the local bureau, of which Col. Nelson is the manager, had practically abolished the National rules and set up rules of their own. Such being the fact, and there being no question of the safety of the work or the ability of the workman, Judge Richardson rendered judgment for the plaintiff, and against the bureau and Col. Nelson, and ordered that defendants pay the $20 damages claimed and issue to plaintiff the usual certificate provided for and necessary in the premises."

At Pittsburg, Pa., on the 18th inst., Judge Buffington handed down an opinion in the U. S. Circuit Court in the case of the Western Electric Company vs. Millheim Electric Telephone Company et al. The suit was for an alleged infringement of a patent for telephone circuit and apparatus known as the multiple system and now owned by the complainant. It was argued at the last term of court at Williamsport, Pa. The opinion is quite a long one and goes minutely into the technical details of the patent. The judge is of the opinion that the defences alleged have not been made good and that a decree should be prepared in favor of the complainant.

CANADIAN NOTES.

The first electric car traversed the streets of the city of St. Thomas, Ont., on the 15th inst. This electric street railway was begun on March 24 and has been completed and was opened for public travel on the 16th inst. The road is six miles long and it cost $80,000.

Hon. John Haggart, of Perth, Ont., and others have been incorporated under the name of "The Canadian Electric and Water Power Company," with a capital stock of $150,000, to produce and distribute electricity in Perth, as well as in other towns in the Dominion.

The works of the Ottawa Carbon & Porcelain Company are very busy at present. This is the only factory in Canada for the production of electrical porcelain and carbon goods. Ever since its establishment at the capital city it has made steady progress.

The Grand Falls Power Company of Grand Falls, N. B., in which Sir William Van Horne, Senator Proctor, Vermont, and Secretary of War Alger are largely interested, have secured additional properties at the falls necessary to carry on operations, and the announcement is now made that the work of harnessing the falls for saw and pulp mills, electric light and other purposes will begin at once. They expect to transmit electric power as far as Woodstock and River Du Loup.

The Carborundum Company of Niagara Falls has commenced the manufacture of its product in Canada under the patent which it holds. It has just erected a new factory building at Niagara Falls, Ont., but the electrical apparatus not having arrived in time for the plant to be utilized in accordance with patent provisions, in order to maintain its rights, the company, with considerable enterprise, erected a furnace in the power house of the Niagara Falls Park & River Railway Company, and there made the first carborundum produced in the Dominion.

A new electric power company has been formed in Ottawa. It will have a capital of $1,000,000. The promoter, Mr. Thos. Lindsay, says: "The company has practically unlimited water power at its disposal. Of course I cannot disclose the source of power at present, but we have 2,000 horse power to begin with and can easily obtain 5,000 more whenever we need it. We intend to supply Ottawa with electricity for light, heat and power. In addition to water power we will have a steam auxiliary."

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING PLANTS.

Brooklyn, N. Y.—New bids are invited for electrically lighting this borough. About two months ago, it will be remembered, at the opening of the bids then received it was found that the bid of the Kings County Electric Light Company was about 4 cents a lamp per night lower than that of its only competitor, the Edison Illuminating Company, and it was thought that the contract would be awarded to it at once, but the council committee having control of the matter held up the resolution that would have permitted Commissioner Kearny to award the contract, and the corporation counsel a few days ago made the discovery that the Kings County Company's bid was invalidated by the fact that the company could not fulfil the requirements of the specifications, not having sufficient facilities. Lately the two competing companies became amalgamated, and now new bids are called for, and in the absence of competition the citizens are looking forward with interest to the canvass of these bids.

Chicago.—Eighteen hundred gas lamps have disappeared from four or five of the city wards within the last two weeks and 300 new arc lights have been installed in their stead; these are operated from the new city light station at Rice and Lincoln streets. The new plant will furnish current for 1,000 arc lamps in the west and northwest portions of the city.

Duluth, Minn.—A resolution has been introduced in the council looking to the erection of an electric lighting plant of 3,500 arcs by the city. The cost is estimated at $89,000, and the resolution calls for a special election August 30 on the proposition to issue bonds to the amount of $100,000 for that purpose.

Duquesne, Pa.—The council and citizens of this town object to a recent increase in the cost of illumination by the McKeesport Electric Light & Power Company, and there is talk of the town erecting a plant in conjunction with the waterworks.

Gaylord, Minn.—The $5,000 electric light bonds having been sold, the village council will receive bids for erection of an electric light plant until August 2.

Houston, Tex.—The Citizens' Electric Light Company has begun the erection of a new building on the site of the old one destroyed recently by a boiler explosion. Blake Dupree, receiver for the company, says the new plant which it is proposed to construct will be up to date in every particular, an iron and brick fire-proof structure, supplied with all the modern electrical lighting appliances.

New Orleans.—An ordinance has been introduced in council which proposes that a contract for electric lighting be given to a company which has made an offer to furnish the city with light for a certain number of years on a novel plan. The contractor is to operate the plant at his sole cost, including the cost of repairs, etc., and insurance for the number of years to be stated in his bid. He is to receive from the city, beginning at the close of the present contract in 1902, the sum of $210,000 annually, payable monthly, the contractor agreeing to take his pay for the construction of said plant out of the profits made by him during this period. At the end of this period the contractor will deliver the plant to the city in good order, and without any further payments from the city. No light shall be furnished to any person or corporation except the city.

Ocala, Fla.—The General Electric Lighting Company has accepted the council's offer of $8,000 in city bonds for its lighting plant. The transfer will take place August 1.

Portland, Ind.—The city's electric light plant was damaged to the extent of about $5,000 by a fire in the building in which it was located on the 14th inst.

Tonawanda, N. Y.—The lighting contract has been awarded to the Tonawanda Light & Power Company on the same terms as existed last year.

Worcester, Mass.—The county commissioners and architects recommend the installation of an independent electric lighting plant for the new county buildings, and it is probable that such a plant will be put in.

STREET RAILWAYS.

Asbury Park, N. J.—Undisputed right of way from Como to Pleasure Bay has been obtained by the Atlantic Coast Railway. The suit of Hutchinson and others against the mayor and council of Belmar, to set aside the franchise recently granted to the Atlantic Coast Electric Railway Company, has been decided in favor of the borough of Belmar, and the franchise was therefore determined to be legal.

Brooklyn, N. Y.—The new Rockaway Beach line of the Brooklyn Elevated Railroad Company has been in operation for several days and is well patronized. The cars start from the New York end of the big bridge.

Chattanooga, Tenn.—The large motors for the Patton motor car of the Chattanooga Rapid Transit Company have arrived and will be set up in the cars in a few days. The officials of the road are confident that the Patton system will fulfil all expectations with the increased power secured by the addition of the large motors. All the suburban lines, it is understood, will be equipped with this system.

Clinton, N. Y.—The New Hartford & Clayville Electric Railway Company is said to have secured the right of way from New Hartford to Clayville, and just as soon as the same can be secured to Clinton the company will be incorporated and begin the work of building the lines. The company, it is stated, will have no lack of capital, and will ask nothing of either village save the right of way. Ex-Supervisor Seaton of New Hartford and C. L. Fitchard of Utica are actively engaged in the preliminary work.

Dayton, O.—The Board of City Affairs has granted a franchise to the Dayton & Western Traction Company, which will operate its cars over the Third and Fifth street lines of the City Railway Company, building a section of track on College street to connect the Third and Fifth street tracks.

Edgartown, Mass.—Interest is being revived in the proposed electric road between this town and Cottage City, and it is thought subscriptions enough can be secured here to insure the building of the line.

Elyria, O.—"The value of an electric railway to abutting property," the "Republican" says, "is beginning to be appreciated. Not long ago a seventy-two acre farm, a short distance this side of Ridgeville, sold for $15,000 to a Cleveland party. Five years ago $10,000 would have been regarded a good price for this property. Owners of property between Elyria and Amherst could safely mark up their lands twenty-five per cent. along the line of an electric railway should one be constructed between the two places."

Grafton, Mass.—The selectmen have granted a franchise to the Grafton, Upton and Milford Street Railway Company to build an electric street railway from the Grafton-Upton boundary line to Farnumsville by way of Grafton Center.

Hartford, Conn.—The third-rail line between this city and Bristol is now in operation. All the steam trains which have run the short trips between this city and Bristol have been discontinued.

Milwaukee, Wis.—Speaking of the Fox River Valley Electric Railway, Henry C. Payne, president of the road, says the line will be extended south to Oshkosh, and north to Kaukauna this year. He says the part of the line now in operation is proving a very satisfactory piece of property. At the annual meeting of the company held at Appleton recently all of the old officers were re-elected.

Nelson, B. C.—C. S. Drummond, who represents the British Electric Traction Company of London, has made application to the city authorities for a 30-year franchise for an electric street railway. If built, this road will be the first of its kind in the Kootenays.

Olympia, Wash.—The car barn of the Olympia Light & Power Company was burned on the 13th inst. Several cars were ruined and the loss to the company is about $15,000, partially covered by insurance.

Penn Yan, N. Y.—A company has been organized, with George F. Andrews, of Oswego, as president, to finish and equip the road from Savona to Keuka, and efforts are being made to secure a connecting line between Keuka and Penn Yan.

Pittsburg, Pa.—The "Dispatch" of the 17th inst. says: "Allegheny county's newest electric railway, the Monongahela line, which is to speedily transport passengers to and from Pittsburg, Braddock and Duquesne, will be in perfect operation shortly after September 1. Wilkins & Davison, the engineers in charge, made this announcement yesterday. The road will be double track along its entire course and the cars will spin along on 90 pound steel girder rails. The cost of the work now being done will probably aggregate $300,000, and the route over which the cars will run has presented more difficult engineering problems than were encountered in the building of any line in the county. The Monongahela Street Railway Company is composed of the Homestead and Highland line and the Homestead and Braddock Traction Company."

Sandusky, O.—The sale of the Sandusky Street Railway has been confirmed by the court and the new owners are in control.

St. Clair, Mich.—The city council has accepted $1,000 in lieu of all claims of the city against John B. Dyar for his failure to put through his projected electric road. Mr. Dyar gave the city a bond for $2,000, but was unable to fulfil his engagements owing to financial obstacles.

St. Louis.—The annual return of the street railways of St. Louis, giving the total number of trips made by cars and the number of passengers carried during the year ending July 1, has been filed with the City Register. The total number of trips on all lines was 1,355,988 and the total passengers carried was 30,013,201. The heaviest showings were made by the Lindell and the Missouri.—Arrangements have been completed for a new electric railway in St. Louis County, from Bobringville, the headquarters of numerous sharpshooters' societies, to a connection with the Southern Electric Railway at Carondelet.

Toledo, O.—The Chamber of Commerce has passed resolutions indorsing the project of building an electric railway from Toledo to Lyons, Mich., a distance of 36 miles, and also agreed to pay Dr. John Smith of Pontiac, Mich., the chief promoter of the road, a cash bonus of $5,000, the amount asked, when the road is completed and in operation.

Washington, D. C.—A certificate of the change of name of the Eckington & Soldiers' Home Railway Company of the District of Columbia to the City & Suburban Railway of Washington has been filed with the Recorder of Deeds.

Watertown, N. Y.—The annual meeting of the Black River Traction Company was held here recently. The officers chosen early in January, when the new company came into existence, held over by tacit understanding. These officers are J. A. Lebkuecher, Newark, N. J., president; H. F. Inglehart, vice-president; George H. Walker, secretary, and B. B. Taggart, treasurer. The reports showed that since the company took charge of the road it has gained business and is now nearer a paying basis.

Worcester, Mass.—A movement is on foot for the consolidation of the Worcester & Marlboro and the Marlboro, Framingham & Southboro Electric Street Railway Companies, and if it is consummated it will mean a ride in the electric cars from West Warren to Boston, through Worcester, Framingham, Natick, Wellesley and the Newtons, a distance of about 80 miles. The Marlboro, Framingham & Southboro line is in process of construction.

MANUFACTURING, ETC.

Cleveland, O.—The Walker Manufacturing Company of this city has, it is said, just received one of the largest single orders ever booked by that firm. The order came from Paris and was for equipment for 500 electric street cars. This includes 1,000 motors, 1,000 controllers, 500 trolleys and other details. The order will amount in value to over $500,000.

Fort Wayne, Ind.—The largest flag in the State was unfurled at the works of the Fort Wayne Electric Corporation on the evening of the 16th inst. The flag is 54 feet 6 inches long and 32 feet 6 inches wide; the stripes are each 2 feet 6 inches wide, while the total weight of bunting used in its construction is sixty pounds. The pole from which the flag is to wave is 150 feet long and is surmounted by a golden eagle of large dimensions. Mr. E. A. Barnes, acting superintendent of the works, in presenting the flag to Mr. Wood, the electrician and general superintendent of the company, said: "Mr. Wood: At the request and on behalf of our faithful employees, I have the honor and great pleasure of presenting to you for Mr. McDonald this beautiful flag and eagle. It is offered not alone as a token of their high esteem for Mr. McDonald and their appreciation of his untiring efforts in their behalf in perpetuating these works and keeping it in this city, where it stands as a creditable monument to its promoters, but also as a testimonial of their loyalty to our glorious country and its cause." Mr. Wood made a pleasing speech in response and read telegrams from Mr. McDonald regretting his unavoidable absence. The flag was then hoisted by the men, while a great cheer rose from the 12,000 spectators who had assembled to witness the ceremony, and the band played the "Star spangled Banner." Some suitable remarks from Mr. Worden followed and then Judge Taylor delivered an eloquent and patriotic address.

TRANSMISSION PLANTS.

Baltimore, Md.—The firm of J. G. White & Co. of this city has been awarded the contract to put in place the equipment necessary to conduct an electric current into Canada from the big power station at Niagara Falls.

Columbus, Ga.—The Columbus Power Company has signed contracts for the erection of one of the largest and finest electric plants in the world, developing 10,000 horse power by water. President H. M. Comer of the Central Railroad of Georgia is head of the company.

Jamaica.—C. O. Palmer, manager of the Sun Life Insurance Company at Kingston, Jamaica, speaks highly of the project of harnessing the Rio Cobre by the West Indian Electric Company, which is one of the largest schemes ever ventured in Jamaica. The works, which have made considerable progress, are situated near the great tunnel at Boy Walk, at which point the river is 160 feet wide. The dam will stretch from one bank to the other, to be imbedded in the solid rock. In order to provide against all contingencies, the dam will be three times as strong as its estimated pressure. The foundations of the dam have already been built. The concrete and masonry sunk in the rock of the river bottom will go ten feet below the water, and above the water the walls of the dam will rise some nine feet. The water is taken in from the dam by a pipe eight feet in diameter. The pipe will convey about 20,000 cubic feet of water, or about 120,000 gallons a minute to the power works. It is provided with a steel valve to regulate and control the supply of water, and runs alongside the river for a mile and a quarter from the dam to the power house. The power house will be built entirely of steel and concrete, the steel work alone weighing 250,000 pounds. The river in its course for a mile and a quarter drops about 47 feet, which, added to the foot of the dam, amounts to 56 feet, which will be the fall of the pipe in its course to the works.

Sanford, Me.—The Sanford Mills Company are erecting a stone dam at the old falls of the Mousam River. The dam is 450 feet long and in places 32 feet deep. Its entire length rests on a solid ledge foundation, thus eliminating all danger of another washout like that which carried away a section of the left wing early in the spring. It is expected that the work of construction will be completed September 1. Work on the power station was begun last week. When completed, 2,500 horse power will be generated, part of which will be transmitted to the Sanford mills, eight miles distant, and part utilized for the Sanford & Cape Porpoise Railroad.

COMPANY MATTERS.

Boston, Mass.—The Railroad Commissioners have authorized the Mystic Valley Street Railway Company to buy the Arlington & Winchester. The Mystic Valley was authorized to issue $50,000 of stock. The roads in question will exchange stock, share for share. The commissioners have also approved an issue of $80,000 bonds, 5 per cent., by the Norton & Taunton Railway Company. The issue will be used for construction purposes.

Kalamazoo, Mich.—W. A. Foote has purchased a three-fourths interest in the Kalamazoo Electric Company from J. K. Wagner, Bush & Tate, and B. A. Bush. The capital stock is $100,000. The plant will be increased and the service improved. The officers are: President. W. A. Foote, Jackson; secretary, S. S. Hulburt, Battle Creek; treasurer, James B. Foote, Jackson. W. A. Foote is now interested in the Battle Creek, Jackson and Albion electric lighting plants.

Newark, N. J.—The People's Light & Power Company of Newark probably holds the record as an absorptive corporation. It now controls and has absorbed the following companies: Newark Electric Light & Power Company, Newark Schuyler Electric Light Company, Thomson-Houston Electric Company, Central Power Company, Consumers' Electric Light & Power Company, Excelsior Electric Company of Harrison, Kearny Electric Light & Power Company, Jersey City Electric Light Company, Hudson County Electric Company, Essex County Electric Company, Suburban Electric Light & Power Company, Montclair Light & Power Company, Edison Electric Light & Power Company, People's Gas Company.

Rockford, Ill.—C. F. Warner, receiver of the Rockford Electric Power Company, has published a notice requesting all persons having claims or demands against the company to present the same to him within sixty days from July 13.

MINES.

Colorado Springs, Col.—The Colorado Electric Power Company's plant is nearing completion. The electric hoists the company installed at the Cripple Creek mines are handsome pieces of machinery, are very compact, will not take one-third of the space required by a steam hoist and can be successfully operated by any steam engineer who knows his business. Aside from the very material saving which will be made by using electric power at the mines, there are many other advantages, for there is no longer any need for the use of coal with all its trouble and dirt. There are no pipes to burst in winter, no boiler repairs, the hoister requires oiling only once a month, and there are many other conveniences which will readily be thought of, which are attendant upon the use of electricity instead of steam for power purposes. The hoists are now being placed on different properties in the camp, and at the rate that orders are now coming in for them it is quite evident that it will be but a very short time before the entire power output of the company will be sold. The electricity will be adapted so that it can be used for hoisting, for running air compressors and pumps, for lighting purposes and for the numerous other things for which power is used in the mines of the camp.

Empire, Col.—A. R. Specht is putting in a plant here to generate electricity to be furnished to mine operators in this vicinity.

Tuscarora, Nev.—The Dexter Company contemplate the establishment of an auxiliary electric plant at their gold and cyanide works to furnish some 300 additional horse power.

ELECTRICIANS IN THE WAR.

Albany, N. Y.—Lieutenant Henry G. Opdyke, United States Volunteer Signal Corps, who has been recruiting volunteers for the corps, has left for Washington with many electricians and telegraphers from Albany. With them have been placed volunteers from other places, the telegraphers numbering more than the others. The men will be at once enlisted into active service and it is supposed will be sent to Manila.

Topeka, Kan.—Frank W. Smith has received a letter from his brother William, who is electrician on the United States gunboat Resolute. The letter is dated Guantanamo Bay, July 6. He witnessed the naval battle which ended in the destruction of Admiral Cervera's squadron and gives a graphic description of the running fight. After the Spanish ships had been driven ashore and the work of rescue began, he says: "The boats brought us over 500 scared looking greasers, who thought we were going to cut their throats and hang them as soon as we got ashore, but they soon found they were in the hands of civilized people who had no intention of harming them. I was surprised when they were brought alongside. Instead of a lot of dirty looking, starved looking villains, they were all dressed in clean white, better than our own men, and each had a bag and outfit in many respects more complete than our own. They all wore clean white pancake hats and looked pretty decent. Some had their pockets stuffed with eatables, canned fruit, cookies, etc., which tended to disprove the statements that they were being starved and led us to believe that they had fared better than we had. But the fact is they had looted their ship when they saw they would have to give her up. No doubt their officers had fared well enough. On the deck of the Cristobal Colon were cows and chickens and the officers had evidently been having fresh milk."

PERSONAL AND MISCELLANEA.

E. F. Hebard, formerly general manager of the Consolidated Traction Company of New Jersey at Newark, has been elected general manager of the Cincinnati & Miami Valley Traction Company in place of W. G. Wagenhois resigned.

The Rockland, Mass., "Independent" says: "H. H. Hallett, who is a born inventor, is devoting his attention to the third rail electric system. The danger to life prevents its use in thickly settled localities, except with the overhead wire. Mr. Hallett is experimenting with a device which will leave the rails uncharged with electricity as soon as the car passes over them. He is confident that he is on the right track and will continue experimenting until his idea is perfected."

Charles Huff, employed by the Citizens' Company at Indianapolis, was killed instantly on the 16th inst. while repairing overhead wires. While standing on a ladder that rested against one of the iron cross-arms of a pole, and in disobedience of the instructions of the foreman and other men on the ground, he grasped the iron arm with one hand and the live wire with the other, forming a short circuit. Huff fell to the tracks senseless, and before his companions could raise him he was dead. He had only been working in the city a short time.

A centipede about eight inches long was found in a coal bin at the Plymouth (Mass.) Electric Light Company's station the other day. One of the men reached down into a cavity in the coal for some purpose and the insect clutched his arm, but was knocked off instantly. Probably being in a cool place made the creature sluggish, and it was unable to inflict the terrible injury that it is capable of. It is probable that the last cargo of coal landed there came in a vessel which had been in some West Indian port, and there the Spanish guerrilla stowed himself away in the hope of nabbing some Yankee.

The Belleville, Ill., "Democrat" states that Michael McKaveny, a motorman on the East St. Louis Electric Railway, resigned his position a few days ago and left for Ireland where, it is claimed, he will receive an inheritance of £20,000 or $100,000. He received a letter from an attorney in Ireland, who informed him that he was a collateral heir of an uncle who died recently. The old man was worth about $200,000, which amount will be divided between McKaveny and his brother.

W. B. Viall has resigned his position with the Stanley Company at Pittsfield, Mass., and has taken an interest in the Eureka Electric Company, buying the share formerly owned by the late Michael Leavey. Arthur Wentworth takes Mr. Viall's place with the Stanley Company.

As a matter of economy the management of the Vincennes, Ind., street railway company advertised last week for women to act as conductors. More than fifty applications were made, and five young women were selected out of the lot. The salary will be only about $5 a week, or $20 per month. The uniform consists of a black suit of much the same pattern as that worn by girls in bicycling. All will wear caps inscribed "Conductor." The girls have made several trial trips, and have been placed on regular service.

A prophecy has been made that it will not be long before there is a belt of smiling gardens and fields crested with palms and inhabited by a contented people on both sides of the ancient river Nile, all the way from Cairo to Khartoum. A scheme is already well under way for tapping the river at the higher level above the cataracts, conducting the water to vertical shafts, down which it will fall to drive turbines, and using the power so generated to run dynamos, from which electricity in the form of alternating or continuous current will be transmitted to points near or remote. The water after passing through the turbines will be restored to the river at a lower level, or else used for irrigating the land. There will be no waste of material, as in burning coal, and no smoke to pollute the limpid air of the desert. Electricity will be applied not only in pumping for the irrigation, but in driving the machinery for preparing the raw products of the soil, spinning cotton, weaving silk and many other industries.

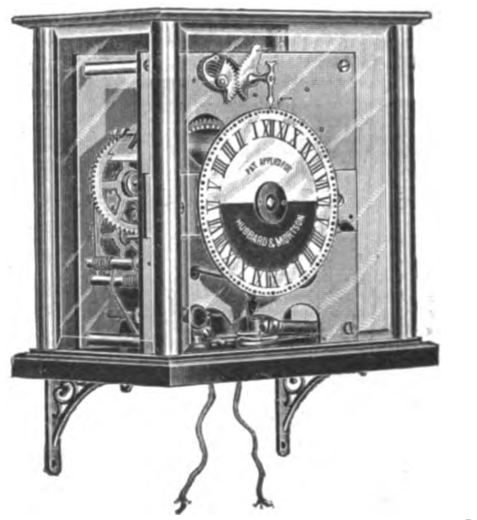
George Bock, engineer at the East End plant of the Allegheny County Electric Light Company, Pittsburg, Pa., was killed by electricity at the company's station on the 14th inst. A high potential current of 5,500 volts from the down town power house is divided in the East End plant, and Bock was about to turn 2,400 volts of this current into wires running to Homewood. Bock was a short man and the switchboard on which the change was to be made was barely within his reach. Two plugs, with insulated handles had to be removed from the top of the board and inserted into holes farther down, and when the man reached these plugs he grasped the bare metal instead of the hard-rubber handles. He succeeded in removing the plugs without sustaining any injury, but when they were placed in the lower holes the entire current of 2,400 volts was passed through Bock's body. As soon as Bock sustained the electric shock he fell forward against the switchboard, not releasing his hold of the brass plugs, however. In this position he was found by his fellow-workmen, who laid him on the floor and immediately made every effort to revive him. Dr. P. J. Eaton of North Highland avenue was summoned and in the meantime the workmen attempted to renew respiration, as is done in cases of drowning. When the physician arrived no signs of life were apparent. The unfortunate man was only 23 years old and unmarried. He had been in the employ of the company 12 or 13 years.

COMMERCIAL PARAGRAPHS.

An Automatic Time Switch.

From time to time several cumbersome and more or less clumsy appliances for automatically turning off electric currents have been put upon the market. These have accomplished the one purpose of turning off the switch, and a simple alarm clock movement has usually released a gravity contrivance whereby the cut-out is accomplished. The Automatic Time Switch Clock, illustrated herewith is the first appliance that has ever accomplished the two-fold movement of turning on and off the electric switch at any time of the day or night at which the clock may be set. This is without doubt one of the most important mechanical appliances for controlling electric circuits and will be of interest to practical electricians, engineers and every householder.

As may be seen from the illustration, the Automatic



Time Switch Clock presents a handsome appearance. It looks like an elegant French clock, with its polished movements, brass corner pillars and panels of plate glass enclosing the clock movement and switch train. The case is mounted upon a substantial base of slate upon which is placed an ordinary four-pole electric switch. The wires to be controlled are cut into this switch in the ordinary manner.

The operation of the time switch is exceedingly simple but most practical and thoroughly effective. A twenty-four hour dial, which makes one revolution every day, revolves under a fixed pointer at the top. At the back of this dial are supplied two movable pointers held in position with sufficient friction by a spring disk. These pointers may be set at any time of the day or night and are fixed rigidly in position when set by pins which engage in a row of holes parallel with the circumference of the disk. When the first pointer reaches the reading point at the top the other end trips an alarm wire which connects with the time hook and sets in motion the train which turns the switch. As time passes the second pointer approaches the point of reading, reaches it and sets the train in motion again, accomplishing the second motion of the switch and turning off the lights. Absolutely all the attention that this requires, after having been set for the hours desired, is winding once a week.

The switch arranged on a slate base meets all the requirements of the Board of Underwriters in the different States as well as the National Board of Underwriters. The Hubbard & Mortson factory, where the new time switch is made, is located at 42 Union Place, Hartford, Conn.

The Electric Appliance Company of Chicago are very proud of the fact that they will soon complete the seventh year of their Electrical Supply business. The Electric Appliance Company claim, and we believe justly, that after confining themselves strictly to the Electrical Supply business as they have for this period of time, they should be in the best possible position to handle that branch of the electrical business successfully. It is very apparent from the volume of business they are now doing and their position in the electrical field that their business has been thus far very successfully handled.

INCORPORATIONS.

The Tuxedo & Embla Park Water & Electric Light Company, Baltimore, Md.—to supply Embla Park and Tuxedo with water and ultimately with electric lights. Capital stock, $25,000. Incorporators: Granville S. Wilson, Henry A. Leonard, John H. Neudecker, Frederick E. Wilson and William F. Smith.

The Hadaway Electric Heating & Engineering Company, New York City. Capital stock, $50,000. Incorporators: Harold S. Mackaye, Harcourt Brigham and Nelson Hiss, all of New York.

The Fairfield Traction Company, Lancaster, O.—to build an electric road in the suburbs of Lancaster. Capital

stock, $100,000. Incorporators: Henry B. Peters, William Davidson, George P. Rising, L. N. Ingham and Frank C. Week.

The Chicago & Fox Lake Electric Railroad Company, Rockefeller, Ill.—to build an electric road from a point in Lake County, Ill., on the east line through McHenry County to west Wisconsin State line. Capital stock, $20,000. Directors and incorporators: John W. Green, Charles E. Soule, Jr., William A. Kawson, Stewart Spaulding, Frank N. Hillis, F. W. Pringle.

The Kinderhook Power & Light Company of Rensselaer County, N. Y.—to furnish electricity for heating and lighting purposes in the cities and villages of Rensselaer County. Capital stock, $50,000. Directors: James Purcell, of Valatie; James R. Hughes, James Hogan and John Ritz, of Stuyvesant Falls, and William D. Barnes, of Brainerd, N. Y.

The Electric Amusement Company, Baltimore, Md. Capital stock, $10,000. Incorporators: John Fay Palmer, of Cleveland, O.; George F. Lurssen, Otto M. Mattfeldt, Arthur L. Herring and Herman H. Lurssen, all of Baltimore.

The Clear Creek Power Company, Denver, Col.—to acquire, hold and develop water rights and generate electric power and sell it in Clear Creek and Gilpin counties, Col. Capital stock, $1,000,000. Incorporators: A. R. Sprecht, Dumont, Col.; F. Rockerfeller, M. A. Bradley, M. Henderson, D. R. Taylor, H. P. Malone and E. G. Tilotson, all of Cuyahoga County, Ohio.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 19, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

607,610. Electric-Railway System. Sidney H. Short, Cleveland, O. Filed May 24, 1897.

607,611. Electric-Railway System. Sidney H. Short, Cleveland, O. Filed July 9, 1897.

607,6 2. Trolley-Base. Harrison G. Taylor, Montreal, Canada. Filed Sept. 27, 1897.

607,697. Electric Railroad. Clarence A. Myers, Atlantic City, N. J. Filed Nov. 18, 1897.

607,414. Car-Fender. James H. Lewis and Joseph M. Courtney, Kansas City, Mo. Filed July 19, 1897.

607,514. Car-Fender. Andrew J. Lawton and David L. Macaffree, Colorado Springs, Col; said Macaffree assignor to said Lawton. Filed March 14, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

607,589. Electric-Arc Lamp. John H. J. Haines, New York City, assignor to the Haines Electric Company, Jersey City, N. J. Filed Oct. 29, 1896. Renewed May 12, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

607,451. Electromagnetic Motor. Archie B. McMillan, New York City. Filed July 7, 1897.

607,469. Box-Filling Machine. Francis H. Richards, Hartford, Conn. Filed Oct. 19, 1897.

607,473. Recording Apparatus for Weighing-Machines. Francis H. Richards, Hartford, Conn. Filed April 16, 1897.

607,475. Weighing-Machine. Francis H Richards, Hartford, Conn. Filed Sept. 25, 1897.

607,510. Electrical Resistance. Harvey S. Chase, Boston, Mass., assignor, by mesne assignments, to the American Electric Heating Corporation, same place. Filed Jan. 11, 1897.

607,551. Electric Regulator. Joseph A. Powers, Lansingburgh, N. Y. Filed Oct. 28, 1897. Renewed June 17, 1898.

607,593. Dynamo-Electric Machine. William B. Sayers, Glasgow, Scotland, assignor to himself and Mavor & Coulson, Limited, same place. Filed Dec. 21, 1897.

607,608. Rheostat Michael J. Shiels, Westfield, N. J. Filed Jan. 7, 1898.

607,6 9. Field-Magnet for Electric Machines. Sidney H. Short, Cleveland, O. Filed May 4, 1896.

607,617. Regulating-Switch for Electric Circuits Harry P. Davis, Pittsburg, and Gilbert Wright, Wilkinsburg, Pa., assignors to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Sept. 18, 1897.

607,621. System of Electrical Distribution. Benjamin G. Lamme, Pittsburg, Pa. Original application filed Jan. 28 1897. Divided and this application filed Dec. 16, 1897.

607,638. Electric-Line Switch. Antoine B. Du Pont. Detroit, Mich., assignor to the Steel Motor Company, Johnstown, Pa. Filed Aug. 12, 1897.

607 672. Controller. Thorsten von Zweigbergk, Cleveland, O., assignor to the Walker Company, same place. Filed April 8, 1898.

607,737. Dynamo Electric Machine. Adolf G. Eigner, St. Petersburg, Russia, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed May 7, 1898.

607,764. Circuit Arrangement for Electrical Apparatus. Julius Meisler, Vienna, Austria-Hungary, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Dec. 13, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

607,801. Long-Distance Telephone. Paul de Kilduchevsky, London, England, assignor to the Kilduchevcky Mega-Telephone Syndicate, Limited, same place. Filed Feb. 10, 1897.

MISCELLANEOUS.

607,590. Galvanic Cell. Albrecht Heil, Frankisch, Crumbach, Germany. Filed Dec. 1, 1897.

607,646 Electrolytic Bath. Pascal Marino, Paris, France. Filed Dec. 1, 1896.

607,714. Electric Stop-Motion for Looms. Alejandro Stephens, Guadalajara, Mexico. Filed June 26, 1897.

607,715. Voltmeter. John F. Stevens, Philadelphia, Pa. Filed April 22, 1897. Renewed May 4, 1898.

607,715. Electric Buoy. Ernest W. G C. Hoffmann, Charlottenburg, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed May 28, 1896.

607,748. Bond for Electric Conductors. Slaughter W. Huff, Baltimore, Md., assignor of one-half to Jesse Hilles, same place. Filed Aug. 29, 1896.

607,794. Apparatus for Cleaning Paint from Ships. Warren F. Freeman, New York City. Filed June 22, 1897.

TELEPHONE AND TELEGRAPH.

The Boston *News Bureau* asserts that officers of the Erie Telephone Company say that "in no section of the United States has telephone competition by independent companies ever gained a profitable footing. For a while, when free passes are given out liberally and the wires and poles are new and stock is sold locally, there is an appearance of prosperity for the new company, but in a brief time they wither, and under active competition with the Bell forces they die." We have no doubt the officials of the Erie Telephone Company would be glad to have the public believe that this statement of theirs was founded on fact, but everybody knows that there are several independent companies in the West that are doing a successful business and have driven the Bell companies out altogether or compelled them to offer almost free service to retain their footing. In Detroit, Fort Wayne, Des Moines and elsewhere, independent companies have been successfully established, and are gaining ground daily in spite of all the opposition that a powerful and resourceful monopoly has brought to bear against them.

In the New York Supreme Court on the 18th inst., Justice Kellogg filed an order denying an application made on behalf of Simon Sterne for the examination before trial of the officers of the Metropolitan Telephone & Telegraph Company, now the New York Telephone Company, in his suit brought to compel the company to furnish him with telephone service at a reasonable rate. Mr. Sterne recently obtained leave from the court to serve a supplemental complaint on the latter company. An application made by Mr. Sterne for leave to examine the books of the two companies was denied. Justice Kellogg also decided that Mr. Sterne had no case against the New York Telephone Company, saying that it had a right to fix its own rates.

In Des Moines, Ia., it is reported that a regular franchise ordinance for the Iowa Telephone Company is being drafted and will be presented to the city council at an early date. It is proposed to make the telephone company accept the conditions of the ordinance and to bring suits in the State courts to enforce the rates in the event it refuses to comply with it. The maximum charges will, it is said, be fixed at $28 for residence 'phones and $42 for business 'phones. except where long distance or desk instruments are supplied. There will also be a clause to the effect that if the company cuts the rate at any time the lower rate made will thereafter be the maximum rate. A decrease in the rate will also be provided for as the number of 'phones used is increased.

On the night of the 14th inst. off Santiago, the Indiana while raising her anchor found that it had fouled something which on examination proved to be the much hunted after cable running from Santiago to Kingston, Jamaica. The auxiliary cruiser St. Louis and the cable steamer Adria had made many attempts to grapple this cable and cut it, as it was the only remaining line enabling Captain-General Blanco to communicate with Madrid, but their efforts were futile and they finally abandoned the undertaking.

Nearly all the schoolhouses in the Borough of Queens, N. Y., will be fitted with telephones during the summer vacation. According to the plans submitted to the Board of Education the cost for running the Queens system for a year will be $3,500, and the cost of equipping the different buildings with instruments and doing the wiring, etc., will be met by the telephone company. The idea is to have the schools connected by telephone and to have them so arranged that they can be called up from the outside.

The Springfield, Mass., *Union* states that the interest in the new telephone company at Amherst is increasing and quite an amount of additional stock has been sold. A meeting to form an organization will be held at once and after that active steps will be taken. Many letters have been received by local parties recommending the automatic system, and it seems probable that this will be the system adopted if the necessary amount of stock is secured.

At Spartanburg, S.C., the Home Telephone Company has applied for a charter and they expect to organize very soon and begin work. They have nearly 300 subscribers, and propose to connect with twelve to twenty neighboring towns in three or four counties. In many of these towns they will have exclusive connection. They propose to use the very best material and the most improved instruments.

It is stated that the Bell Telephone Company of Philadelphia contemplates increasing its capital stock from $2,000,000 to $4,000,000. A meeting will be called at an early date to take action on the proposed increase.

A despatch to the Burlington *Hawkeye* from Chariton, Ia., states that the Chariton & Newburn Telephone Company has determined on two important extensions of its lines which will be made this year. It will build a line from Lacona to Indianola, having made arrangements for a connection from Indianola into Des Moines. This will give Chariton a direct Des Moines connection.

The Toledo, O., *News* says a syndicate composed of Bowling Green men has purchased George B. Hull's interest in the Harrison Telephone Company. The new owners have elected the following officers and directors: President, L. C. Cole; secretary and general manager, R. E. Connelly; directors: L. C. Cole, John R. Hankey, H. Froney, R. S. Patty, R. E. Connelly.

The New York Telephone Company has published a card giving its rates for telephone service in New York and vicinity. They are: In Manhattan Borough, from $90 a year; in the Bronx, from $40 a year; in Westchester County, from $30 a year. Extension stations are now only $1 a month, with installation charge.

Justice Stover, in the Supreme Court at Brooklyn, N. Y., on the 22d inst., refused a mandamus asked for by J. F. Miniter, to compel the Western Union Telegraph Company to forward a telegram without charging an extra cent for the revenue stamp. Justice Stover's interpretation of the law is that the sender of a message must affix the stamp.

In the quarterly report of the Electric Bureau of the National Board of Fire Underwriters, just out, the statement is made that the number of telephone burnouts and fires from lightning and from various crosses on electric light wires shows the necessity of better protection of signal circuits.

After hearing preliminary arguments of opposing counsel in the injunction suit brought in the U. S. Circuit Court at Detroit, Mich., by the Western Electric Company against the Detroit Telephone Company, Judge Swan gave the attorneys until August 10 to file briefs.

The Washington, D. C., druggists who have sub-postal stations on their premises and who removed their telephones because of a disagreement with the telephone company have been compelled to reinstate the telephones by order of the Post Office Department.

The Erie Telegraph & Telephone Company report an addition of 1,001 subscribers to their system during the three months ending June 30. The total number connected July 1 was 26,693.

In the Philippine Islands there are 720 miles of telegraph, but Manila is the only town that has a telephone system. It is owned by English capitalists.

The Automatic Telephone Company will probably get a franchise in Rochester, N. Y. The committee that has the matter in charge is expected to make a favorable report to the council.

The Colorado Telephone Company has been granted a twenty-year franchise to operate an exchange in Berkeley, Col.

Mayor Warwick has signed the Drawbaugh telephone bill which was passed by the Philadelphia councils recently.

The Western Union Telegraph Company announces that its office at Santiago de Cuba is open for business.

New Companies Incorporated.

The Alvin & Angleton Telephone Company, Alvin, Texas—to operate telephone lines in Brazoria county. Capital stock, $2,000. Incorporators: O. S. Cummings, A. J. Birchfield, F. J. Bush, A. W. Wilkerson and W. A. Leonard.

The Red River Telephone Company, Shreveport, La—to construct a telephone system from Briarfield to Shreveport. Capital stock, $800. President, W. A. Martin; vice-president, J. M. Seutell; secretary and treasurer, R. T. Glassell.

The Citizens' Telephone Company, Magnolia, Miss.—to establish a telephone system. Incorporators: J. E. Wolfe, T. B. Lampton, J. E. Norwood, P. H. Enochs, W. E. Payne and others.

The Home Telephone Company, Cleveland, O. Capital stock, $500,000. President, H. A. Everett; vice-president, E. W. Moore; treasurer, John Shermin; secretary, F. R. Price.

The Albuquerque-Bland Telegraph & Telephone Company, Albuquerque, N. Mex. Capital stock, $10,000. Incorporators: W. F. Powers, Belvidere Brooks, John Dickey and Anthony Conrad.

The Sylvan Springs Telephone Company, Clayton, Ill. Capital stock, $1,500. Incorporators: G. L. Thompson, John Padgett and John W. Butz.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N Y.—July 25:						
Albany Ry. Co.	100	2,000,000	$1,750,000	1¾ % Q., Feb. '98.	146	148
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	68	70
Traction Co. (Saratoga)	100	50,000	50,000	......	.	..
Allentown, Pa.—July 25:						
Allentown & Lehigh Val. Trac. Co.	..	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—July 25:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	35	..
Baltimore, Md.—July 25:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	..	72⅛
aBaltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23⅛	23⅜
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—July 25:						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	..	..
North Shore Traction Co. ...com.	100	4,000,000	4,000,000	....	10	14
North Shore Traction Co. ...pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	72	75
b West End Street Ry. Co. ...com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	..	85¼
b West End Street Ry. Co. ...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	105	106
Boston Elevated R. R.	100	10,000,000			66¼	66½
Brooklyn N. Y.—July 25:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	205	210
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	54⅞	55⅛
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR. ...guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	210	..
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	210	..
Kings County Elevated	....	4,750,000	4,750,000	....	4	..
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	47	..
Nassau Electric Railroad	....	6,000,000	6,000,000	....	..	...
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—July 25:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	....	55	60
*Buffalo Railway Co.	100	6,000,000	5,370,500	1 % Q. Dec., '97.	80	82
Columbus O.—July 25.						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb., '98.	49	50
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—July 25:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co.	25	1,000,000	250,000	....	..	..
Chicago, Ill.—July 25:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	270	275
Chicago & South Side R. T. RR.	100	10,323,800	10,323,800	....		
Lake Street Elevated RR.	100	10,000,000	10,000,000	....	12½	18
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	....	..	2½
Met. West Side El. const. stk.	100	15,000,000	2,500,000	....	..	...
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Jan., 98.	215	...
hNorth Chicago City RR.	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co.	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	92⅛	93¼
jChicago West Div. Ry. ...guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry. ...guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—July 25:						
Cincinnati Inc. Plane Ry. ...com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry. ...pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co.	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	114¼	114½
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.		
Cleveland, Ohio.—July 25:						
Akron, Bed. & Clev. Elec. Ry.	100	1,000,000	1,000,000	¾ % Jan., '98	37	39
Cleveland City Ry.	100	8,000,000	7,600,000	¾ %., Oct., '97.	56¾	62½
Cleveland Electric Ry.	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	59½	60
Detroit, Mich.—July 25:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co.	....	250,000	250,000	....	..	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry.	100	250,000	200,000	....	100	110
Dayton O.—July 25:						
City Railway Co. ...com.	100	1,500,000	1,470,600	1¼ % Q., Jan.1,'98.	100	102
City Railway Co. ...pfd.	100	600,000	600,000	1½ % Q.,Jan. 1, '98	150	155
People's Street Railway	....	1,100,000	....	....	100	..

* Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—July 25:						
Hartford Street Ry. Co.	100	$4,000,000	$200,000	3 % S., Jan., '98.	140	--
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	--
Holyoke Mass.—July 25:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—July 25:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70	--
Indianapolis, Ind—July 25:						
**Citizens' Passenger Ry.	...	5,000,000	5,000,000	....	27	30
Lancaster, Pa.—July 25:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000	....	..	--
Lancaster & Col. Electric Ry.	....	....	87,500	....	..	--
West End Street Railway	....	....	....	....	..	--
Louisville, Ky.—July 25:						
Louisville Ry. ...com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	37	38
Louisville Ry. ...5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	97⅛	98
Minneapolis, Minn.—July 25:						
Twin City Rapid Transit ...com.	100	17,000,000	15,010,000	....	18	23
Twin City Rapid Transit ...7 % pfd.	....	3,000,000	1,714,200	1¾ %, Jan., '98.	..	100
Montreal, Canada.—July 25:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	261¾	265½
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1¾ % S., J. & J.	96¾	97¼
Memphis, Tenn.—July 25:						
Memphis Street Railway Co.	100	500,000	500,000	....	15	--
New Haven, Conn.—July 25:						
Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co.	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	--
Winchester Avenue RR.	25	1,000,000	600,000	....	40	42
New Orleans, La.—July 25:						
Canal & Claiborne RR. Co.	40	240.000	240,000	4 % S., Jan., '98.	146	170
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co. ...com.	100	5,000,000	5,000,000	....	1	4
New Orleans Traction Co. ...pfd.	100	2,500,000	2,500,000	....	5	10
aCrescent City RR. ...guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	32
bNew Or. City & Lake RR. ...guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	8[illegible]	88
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	18	22
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	53	54½
New York—July 25:						
Central Crosstown RR.	100	600,000	600,000	2½ % Q., July, '97.	240	..
cChristopher & 10th Sts. RR. ..guar.	100	650,000	650,000	2 % Q., Jan., '98.	150	160
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98.	175	195
dMetropolitan Street Ry. Co.	100	30,000,000	30,000,000	1¼ % Q., Jan., 98.	151	151¼
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	32	34
fBroadway & Seventh Ave. ..guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	210	220
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98.	180	185
hEighth Avenue RR.	100	1,000,000	1,000,000	....	320	350
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q., Feb., '98.	340	360
jNinth Avenue RR. ...guar.	100	800,000	800,000	....	180	..
kSixth Avenue RR. ...guar	100	2,000,000	2,000,000	....	200	210
lTwenty-third St. R. R. Co. ..guar.	100	600,000	600,000	4½ % Q. Feb., '98.	380	..
Second Avenue RR.	100	2,500,000	1,862,000	2 % Q., Jan., '98.	175	...
Third Avenue RR.	100	12,000,000	10,000,000	2 % Q., Feb., '98.	175	178
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	55	61
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—July 25:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	48¾	49
Newark Passenger Ry.	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry.	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—July 25:						
Allegheny Traction Co.	50	500,000	500,000	....	..	..
oConsolidated Traction Co. ...com.	50	15,000,000	15,000,000	2 %, Jan., '95.	14⅝	14¾
Consolidated Traction Co. ...pfd.	50	15,000,000	15,000,000	3 %, May, '97.	48⅞	49¼
pCentral Traction Co.	50	1,500,000	‖900,000	....	...	...
qCitizens' Traction Co.	50	3,000,000	‡3,000,000	6 % A.	62½	...
rDuquesne Traction Co.	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co.	50	2,500,000	1,900,000	3 %, Aug., '95.	..	...
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	..
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	‖2,994,839	2 %, Aug., '95.	..	24½
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	..	..
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 97.	18⅓	19
Second Avenue Traction Co. ...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co.	50	300,000	200,000	....	..	..

* Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October,

s Leased to Consolidated Traction Company for [illegible] % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—July 25						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	158
Northampton, Mass—July 25						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	168	175
Omaha, Neb.—July 25:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—July 25.						
Paterson Ry. Co	100	1,250,000	1,250,000	....	35	36
Providence, R. I.—July 25.						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	64	67
Philadelphia.—July 25:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '97.	43½	45
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—Jan, 10, '98.	65⅛	66
aFairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3 % Feb. 1, '98.	65	66
Union Traction Co............ $12½ pd	50	30,000,000	29,930,450	....	18⅛	..
cElectric Traction Co	50	....	8,297,920	....	71⅜	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.97	390	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 97	256	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '97.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	185½	..
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	89⅛	89¼
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '97.	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '97.	142½	..
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '97	175	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '97	90¼	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '97.	288	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '97.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '97.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '97	275	...
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '97	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '97	225	230
Rochester, N. Y.—July 25:						
Rochester Railway Co	100	5,000,000	5,000,000	....	10	12
Reading, Pa.—July 25:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..
kCity Passenger Ry	50	350,000	350,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	64	..
St. Louis Mo.—July 25.						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % July, '98.	125	127
National Railway Co	..	2,500,000	2,479,000	1½ %, July, '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '93.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	800,000	50c., Dec., '89.	..	..
Southern Electric Ry...........com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	110	112
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	54	56
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—July.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	107	108
Geary Street Park & Ocean RR	100	1,000,000	375,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅝	53¾
Presidio & Ferries RR	100	1,000,000	550,000	....	...	8½
Scranton, Pa—July 25:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
m Scranton & Carbondale Trac. Co.	100	500,000	500,000	....	..	18
m Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—July 25:						
Springfield Consolidated Ry	100	750,000	750,000	....	....	11
Springfield O.—July 25:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—July 25:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—July 25:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	96¾	97¼
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	264¾	265½
Washington, D. C.—July 25:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	73⅛	74
Columbia Ry. Co	50	400,000	400,000	6 % A.	77	78
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	121	123
Worcester, Mass.—July 25.						
*Worcester Traction Co........com.	100	8,000,000	8,000,000	....	15½	17
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	95	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—July 25:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—July 25:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., Jan., '98.	274½	275
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	69	70
New England Telephone Co	..	10,394,600	10,804,600	$1.50 %, Feb. '98.	132	..
New York.—July 25:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	91½	95½
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1¾ % Q.	100	108
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	170	180
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	44
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan., '98.	69	70
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	108	110
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	107	110
Mexican Telephone Co	100	2,000,000	......		.59½	.65
*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1½ % Q., Jan., '98.	148	151
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	72	77
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	90	95
†Commercial Union, Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	113
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	92⅝	92⅞
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—July 25:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	170	175
Chesapeake & Potomac Telep. Co.	100	......	......	....	59½	60½
Chicago Telephone Co	100	......	......	......	202	..
Central Dist Prtg & Telg. Co. (Pgh.).	100	750,000	750,000	....	..	..
Empire & Bay States Telegraph Co.	...	......	......	....	72	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	79	78
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	110	115
Providence (R. I.) Teleph. Co	50	....	......	....	85	85½
Southern New Eng. Teleph. Co	100	3,000,000	......	....	119	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—July 25:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
General Electric Co............com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	39⅛	39⅜
General Electric Co............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	98	95
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	3
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	....	24½	25
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., July, '98.	54	55
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—July 25:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,988,000	....	127	132
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '97.	122	122½
Edison Ore Milling Co	100	......	......	....	10	18
Edison Electric Storage Co	..	......	......	....	21	25
General Electric Co............com.	100	40,000,000	30,460,000	2 % Q., Aug, 1898.	39⅛	39⅜
General Electric Co............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	98	95
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co....pfd	..	......	......	...	..	..
Pittsburg, Pa.—July 25:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	180	..
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—July 25:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	83½	84
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	86	86½
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$32500 dis. Jan.11'97	13½	14
Southern Elec. Light & Power Co.	10	187,500	187,500	....	8	10
Miscellaneous.—July 25:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	82½	85
Missouri-Edison (St. Louis)....com	..	......	......	....	11	15
Eddy Electric Mfg. Co	25	......	......	....	....	15
Hartford (Conn.) Elec. Light Co	100	350,000	......	....	120	130
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	4½	10
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	160	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	88	90
Rhode Island Elec. Protec. Co	100	......	......	....	110	120
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q	*158	160
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	136⅛	136½
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	.....	......	....	100	110
						*ex d.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—July 25:						
American Electric Heating Co	50	10,000,000	....	....	.05	.07
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	35	37
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—July 25:						
Consolidated Electric Storage Co	...	......	....	....	18	20
Edison European	..	......	....	.....	1	3
Safety Car Heating & Lighting Co.	100	......	....	......	..	98½
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	80	38
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	90	92
Philadelphia, Pa.—July 25:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000.000	......	....	74½	..
Welsbach Commercial Co.....com.	100	3,500,000	......	....	19½	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	73	75
Welsbach Light Co	5	525,100	......	....	56½	57½
Welsbach Light Co., Canada.	5	500,000	......	....	1½	1¾
Pittsburg, Pa.—July 25:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	110	112
Miscellaneous.—July 25:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	..	15
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	...	65
Billings & Spencer Co	25	......	......	....	30	37
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	30	35
Johns-Pratt Co	100	......	......	....	..	97
*Pratt & Whitney Co..........com.	100	......	......	....	..	10
*Pratt & Whitney Co............pfd	100	......	......	....	45	52
Stillwell-Bierce Co.............com.	..	......	......	....	96	98
Stillwell-Bierce Co..............pfd.	..	......	......	2 % Sept. 1, '97.	107	109
Shults Belting Co	100	500,000	......	....	60	80
St. Charles Car Co	..	....	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—July 25, 1898

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
The Albany Ry..............1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co.......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*111	.....
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	.....
‡Watervliet Turnpike & RR..1st mtg. 6s	350,000	350,000	1919	M. & N.	*117½	.....
‡Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	.....
Troy City Railway Co..............1st 5s	....	....	......	......	*105	105½

†Interest guar. by Albany Ry. Co.
‡Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—July 25, 1898

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113½	114
Baltimore Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	113½	114
Baltimore Trac. Co..Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	103½	104
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116½
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	102¼	102¾
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co...........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	116	117
City & Suburban Ry.......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	114	......
Lake Roland Elev...............1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	....
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	118	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
†Lynn & Boston RR.........1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	101½	105
West End Street Ry...........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104	105
West End Street Ry.........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—July 25, 1898

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
†Enterprise Street RR..........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry.............1st mtg. 5s.	350,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101½	102¼
†Chicago Passenger Ry.....1st mtg. 5s.	400,000	400,000	1903	F. & A.	......	102
‡Chicago Passenger Ry....Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
‡Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	......	....
Chicago & So. Side R. T...............4½s.	1,500,000	750,000	1907	J. & J.	......	....
§Chicago West Div. Ry.......1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	108½	....
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	......	....
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	54	54¾
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105
North Chicago St. RR......Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	108
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry......consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	104	104¼
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	101½	....
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	99½	99⅞
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	....	91
‖W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 ds. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
§Subject to call after Oct. 1, 1899, at $110 and interest.
|Assumed by W. Chi. RR. Co., lessee.
‖Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
Cin. New. & Cov. St. Ry. 1st Gen. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	102	102½
*Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	108
†Mt. Adams & Eden P'k In....1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
‡Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	581,000	581,000	1906	M. & S.	107½	108½
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
§So. Cov. & Cin. St. Ry.........2d mtg. 6s.	400,000	400,000	1932	J. & J.	181	182

† Assumed by the Cincin. St. Ry. Co.
‡$380,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
aBrooklyn Street RR. Co.......1st mtg. 6s.	600,000	600,000	1908	M. & S.	106	107
Cin. New't & Cov. St. Ry...Cons. mtg. 5s.	3,000,000	2,800,000	1922	J. & J.	102	102½
Cleveland City Cable Ry....1st. m g. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
‡Cleveland Electric Ry. Co. 1st mt. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103½	105
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	....
aEast Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102	105
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 5s.	600,000	....	1923	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	......	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked a.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,585,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	.....	105

†$1,188,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1913	M. & S.	105	......
New Haven (Edgewood Div.) 1st mtg. 5s	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	105	....
Winchester Avenue RR....Deben. g. 5s.	150,000	94,000	1900	M. & S.	101	....

New Orleans La.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	101	....
Crescent City RR.............1st mtg. 6s.	......	50,000	1899	M. & N.	100½	....
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1948	J. & J.	76	79
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1908	J. & D.	105	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100¼	101¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	110	....
Orleans Railroad Co.......Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	101½	....
‡St. Charles St. RR. Co.......1st. mtg. 6s.	350,000	75,000	1906	J. & D.	104¼	....

†$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	106	109
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	110	112
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	114	116
Broadway Surface............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106½
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	115½
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	87
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	103	...
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	105½	108
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	90
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	108½	.....
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	....	101	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	111½
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118½	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	106
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100	*108
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	104	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115	118
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	93
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	121	122
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	115	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108½	109½
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	....	107	......
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	121	122½
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	108	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	111	118
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112½

†$1,085,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
Montreal St. Ry......................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorised. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
Continental Pass. Ry...........1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry...................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	....	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	....	1943	....	102	103
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry.......1st mtg. 7s.	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry..............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co................Col tr. 4s.	29,785,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s.	....	....	1905	....	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115½	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116½

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	....	......
Central Traction Co...............1st mtg. 5s.	875,000	875,000	1930	J. & J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	....	107½
*Fed'l St. & Pleas. Val. Jack's Run......5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	106½	....
Millvale, Etna & Sharpsburg...............5s.	750,000	750,000	1928	M. & N.	105	......
Pittsburg, Crafton & Mansfield............5s.	250,000	250,000	1924	J. & J.	....	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	113	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co....................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation—July 25, 1898.

Name	Amount Authorized	Amount Issued	Due	Interest periods	Bid	Asked
†Baden & St. Louis RR.........1st mtg. 5s.	250,000	250,000	1913	J. & J.	100½	101½
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,961,000	1912	J. & J.	101½	102½
Citizens' Railway Co..............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 5s	1,000,000	1,000,000	1912	J. & J.	111	112½

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—July 25. 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	$50,000	$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co........................1st mtg. 5s	1,500,000	1,500.000	1911	F. & A.	10[illegible]½	107½
Missouri RR. Co...........................	1,000,000	700,000	1916	M. & S.	106	107
‡Mound City RR. Co..............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	103
People's RR. Co......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co.....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co.................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry................Income 5s.	800,000	800,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110½	111½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,737,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation— July, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114¾	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	113½	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	92½	97½
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1913	J. & J.	126	....
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	124½	......
†Park & Cliff House RR........1st mtg. 6s.	850,000	850,000	1912	J. & J.	109	......
†Park & Ocean RR..................1st mtg. 6s.	250,000	250 000	1914	J. & J.	88½	110
†Powell St. Ry.........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118½	120
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109¾	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—July 25, 1898.						
Belt Ry. Co.........................O[illegible] mtg 5s.	500,000	450,000	1920	J. & J.	33	....
Columbia Ry.............................[illegible] mtg. 6s.	500,000	500,000	1914	A. & O.	118	122
Eckington & Soldiers' Home [illegible] mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	118	119½
†$50,000 in escrow to retire 1st mtg.bds.						
Miscellaneous.						
Date of Quotation—July 25. 1898.						
Bridgeport Traction Co.........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	104	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	111¼	112
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	108½	109¾
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	100	101
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	105¼	105½
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	106
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	79
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	114	114½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	90	93
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	8,000,000	2,878,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	96	....
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—July 25. 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	104	....
Pittsburg, Pa.						
Date of Quotation—July 25, 1898						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1913	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(July 25,1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	110	. . .
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117½	......
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...		....	......
Edison Illg. Co. (St. Louis)..............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—July 25. 1898.						
American Bell Telephone...................7s.			1898	F. & A.	100	....
Northwestern Telegraph Co...............7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—July 25, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co....................	....	....	......	......	......	25
*Barney & Smith Car Co.....................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co.........................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co..............................	75,000	......	......	......	....	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11@11⅛c.; Lake, 11½c.; casting, 11@11⅛c.

The Worcester & Marlboro (Mass.) Street Railway Company has declared a semi-annual dividend of 3 per cent., payable August 1 to stock of record July 25.

The directors of the Wilmington (Del.) City Electric Company have declared a half-yearly dividend of 3½ per cent., payable to stockholders of record July 1.

The American District Telegraph Company of Philadelphia has declared a quarterly dividend of 1 per cent., payable August 15 to stock of record August 5.

The Dry Dock, East Broadway & Battery Railway of New York has declared a quarterly dividend of 1½ per cent., payable August 1. Transfer books reopen August 2.

Ferdinand Peck, of Chicago, has been appointed by the President as Commissioner General of the United States to the Paris Exposition. Chicago will be the headquarters of the Commission.

On the 19th inst., the directors of the Hartford (Conn.) Electric Light Company declared the regular semi-annual dividend of 3 per cent., payable on August 15 to stockholders of record August 1.

The North Jersey Traction Company has sent to Comptroller Gibson of Newark a check for $72,135.74, this being the 5 per cent. franchise tax due the city on its gross earnings. Last year the sum was $67,959.38.

A director of the Manhattan Elevated Railroad, New York, says: "No definite action will be taken in reference to the adoption of electricity until after the franchise question has been settled. When Mr. Gould returns the franchise matter will again be taken up."

The Dallas (Tex.) Consolidated Electric Street Railway has executed a mortgage on all its property to secure the Union Trust Company of St. Louis for the payment of $800,000 worth of bonds just issued and negotiated. The loan is said to be for the purpose of paying outstanding indebtedness and to improve the property of the Consolidated system.

The annual statement of the Union Traction Company of Philadelphia for the year ending June 30 shows: Receipts from all sources, $10,971,437.59, increase $490,791.61; operating expenses, $4,456,375.26, decrease $493,475.18; net receipts, $6,515,062.23, increase $984,266.79; fixed charges and taxes, $6,490,441.75, increase $107,711.38; surplus, $24,620.58.

In addition to the regular dividend and rights to subscribe for additional stock at par, the stockholders of the Edison Electric Illuminating Company of Brooklyn will shortly be informed, says the N. Y. "News Bureau," that the cash surplus in the treasury will be divided before t. e company is transferred to the Kings County Company. The amount is between 3 and 5 per cent.

The Quincy & Boston Street Railway Company, which for the last fiscal year ending September 30 carried 1,200,000 passengers, has made a gain to July 1, 1898, of 247,000 passengers. The last quarter of the fiscal year to September 30 is considered the best quarter of the year. It is therefore estimated the road will carry this fiscal year above 1,500,000 passengers. The company pays 7 per cent. and the balance above this amount is charged off.

The board of directors of the Drawbaugh Telephone Company held a meeting at the office of the company in Philadelphia on Monday, when it was announced that the company is ready to begin operations on the establishment of the new line in that city, although six months is allowed by the ordinance recently passed by councils. Col. J. F. Stokes, president of the company, said that the line would be started just as soon as possible, and it is hoped to get it into operation within a year.

Under the reorganization plan of the Metropolitan West Side Elevated Railway of Chicago the holders of the present $15,000,000 5 per cent. bonds will receive 60 per cent. of the face of their holdings in new 4 per cent. bonds and 53⅓ per cent. of the face (which includes arrears of interest) of old bonds in new 5 per cent. non-cumulative preferred stock. The $15,000,000 of common stock is assessed $4 a share (for which assessment the stockholders will receive new 4 per cent. bonds) and it is scaled 50 per cent. A syndicate has been formed to underwrite the assessment.

The New York State Board of Railroad Commissioners has granted the application of the Nassau Electric Railroad Company (Brooklyn) for permission to increase its capital from $6,000,000 to $15,000,000. The new stock is to be divided into $6,500,000 of 4 per cent. preferred stock and $8,500,000 of common stock. The increase is for the purpose of improving the system by consolidating several railroads into one and providing money for further betterments to the property. The properties which will be included in the new Nassau Railroad system are the same as those which it now operates, but the securities of them all will be now known as Nassau Railroad stock and bonds.

The "Financial Chronicle" states that a director of the Metropolitan Street Railway makes the following explanation regarding the new stock issue to be voted upon August 9: "The public does not seem to have the correct idea about that $15,000,000 of additional stock, apparently believing that $5,000,000 more stock than was at first supposed is to come on the market. Such is not the case. The board thought that as an increase in capital was to be asked for it might as well be $15,000,000 as $10,000,000; $5,000,000 of this, however, will be held in the treasury, in reserve, as announced, and to the best of my knowledge there is no immediate prospect of its being issued therefrom to acquire property, make betterments, or for any purpose whatsoever. The $4,000,000 balance of the $10,000,000 to be issued, over the amount required to retire the scrip, should be sufficient to complete the Sixth and Eighth avenue lines and make the change in the motive power."

A meeting of the stockholders of the Central Traction Company of St. Louis will be held July 30 to increase the capital stock of the company from $100,000 to $5,000,000. John H. Blessing, secretary of the company, says: "This step is necessary in order to provide the large amount needed to build the road. The franchise has been accepted and all the details have been practically arranged, but of course the action must be ratified by the stockholders." The officers of the company are R. M. Snyder of New York, president; John H. Blessing, secretary. The board of directors consists of these officers and Finis E. Marshall, cashier of the Continental Bank of St. Louis; H. S. Potter of Boston, and J. S. Bache of New York.

The fourteenth annual meeting of the Royal Electric Company was held in Montreal, Can., on the 19th inst. The old board of directors was re-elected. The fiscal year ended on May 31 last. The gross amount for the year to credit of the revenue accounts for the business transactions of the company aggregat d $955,826. The expenditure for labor, materials, operation, maintenance and general expenses amounted to $636,057, leaving a gross profit of $319,769. From this is to be deducted interest and fixed charges amounting to $42,609, making an aggregate net profit to the company for the year of $277,160. From this net profit there have been declared four quarterly dividends of 2 per cent. each to the total amount of $120,000.

The Brooklyn "Eagle" says: "Plans for the operation of the consolidated electric light company, which will be composed of the Edison, Kings County and Municipal corporations, are now being discussed by the men in control of these properties. The complete plans have not been decided upon as yet, but as soon as the pending consolidation is formally concluded, which, it is thought, will be about October 1, the entire property will be placed under one management. This, it has been estimated, will result in an annual saving of over $100,000." It is thought more than likely that President Ethan Allen Doty of the Edison Company will be the executive head of the consolidated company.

ELECTRICITY.

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ELECTRICITY

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CONTENTS.

EDITORIAL NOTES.

The Electrolytic Marine Salts Company.

The Rev. P. F. Jernegan, formerly a Baptist minister but better known as the inventor of an alleged method of extracting gold and silver from sea water and as promoter of the "Electrolytic Marine Salts Company," recently sailed for Europe with a trunk full of Government bonds purchased with cash and under circumstances that were, to say the least, suspicious. What is known as the Electrolytic Marine Salts Company was organized last November under the laws of Maine with a capitalization of $10,000,000 in shares of one dollar each. The company was based on a secret process for which it was claimed that by means of electricity and by the use of a "certain" chemical large quantities of the precious metals could be extracted from the sea water at every tide. A recent issue of the New York *Herald* says:

"In the prospectus the rather blind statement is made that nine-tenths of the stock (of $10,000,000) is held in trust and will be sold for the joint benefit of the discoverers and their associates and the treasury. Another equally blind statement is made that 'Only such proportion of the stock as is actually sold is entitled to retain dividends.'

"The prospectus further says: 'It has purchased from the inventors their processes for the extraction of gold and silver from sea water. These processes are not patented, but they are secret. While it is true that competition cannot seriously injure this company, such is the enormous demand for gold and so great is its commercial start of any similar company that might be formed, it may be noted that its secrets are carefully guarded day and night, the construction of the plant and the character of the employees being such that any successful attempt to discover illicitly its process is foredoomed to failure.'

"Here is a description of the first plant from the prospectus:

"A salt water lagoon, with 49,000 tons capacity each tide, a dam, wharf and grist mill, and two dwelling houses were purchased at North Lubec, Me., and a plant installed. The work was of a new and difficult character. Much of it had to be done between tides and in the night. But it was built quickly, well and cheaply, and began running February 4, 1898.

"At this date the board of directors visited the works and made a two weeks' inspection of them. From nearly a hundred that were in operation, five accumulators were selected that had run a week, and their average extraction of gold proved to be 7.87 dwt. weekly for each. The daily product in gold and silver of each accumulator was in value $1.27. An accumulator run two weeks showed an extraction of 16.1 dwt. gold.

"At the conclusion of the directors' so-called investigation it was said to be their opinion that on a correspondingly larger scale, with 150 accumulators, they could take out $100 worth of gold at an expense of $10—in other words, by May 1 could be producing $2,000 a week net profits. In regard to the secret process the circular says:

"'It is obvious that investors must depend on the veracity of competent witnesses and the accumulation of earnings for their confidence in this process.'"

We have several times referred to this company in our columns, and no later than June 8 made the statement that this scheme should in our opinion be classed in the same category with the Electropoise, electric combs for turning hair from white to black, and with electric shoes, which a firm in England had recently brought out. In another issue, namely that of December 1, 1897, ELECTRICITY also pointed out that what traces of gold and silver there were to be found in sea water were mostly in the form of chlorides and could only be obtained by the most careful and lengthy analyses. Scientists have worked on the problem for years and have utterly failed to devise any method that would pay for itself. Such being the case, was it natural to suppose that a man with little or no scientific training could devise a paying method in the short space of a year or two? Further, if the process devised by the Rev. P. F. Jernegan was such an overwhelming success, why were ten millions of shares of stock issued and placed on the market at the nominal price of a dollar a share, thus offering an extra inducement to people of small means to invest? That there are reputable men connected with the enterprise is not to be doubted, and we understand the stockholders are about to investigate the Rev. P. F. Jernegan's sudden trip to Europe and various other matters.

The New York *Sun* of August 1, in an article from Lubec, Me., dated July 31, says:

"Angry stockholders from all over New England are arriving to investigate the alleged secret process of extracting gold. It is said on the authority of one of the workmen that Jernegan infused gold dust into the mercury accumulators regularly toward the close of each month, resulting in the monthly gold brick. When the accumulators were opened yesterday (July 30), as usual at the close of the month, nothing but seaweeds were found, with slight traces of gold on the accumulators."

The Electric Sugar Refining Company, whose bubble burst so disastrously in 1888, was considered a bad swindle, the much-abused word "electric," as in this case, being used as a bait for the unsuspecting public, but if anything this electrolytic salt water gold scheme may prove even a worse one, as almost $1,000,000 have been invested in it by innocent New Englanders.

Mechanical Draft for Steam Boilers.

In the case of electric lighting plants or other central stations where a large amount of power is generated, the question of providing a suitable draft for the boilers from the standpoint of economy and efficiency is an all-important one. We are in receipt of a paper entitled "Mechanical Draft for Steam Boilers," by Walter B. Snow, which was delivered in the form of a lecture before Sibley College, Cornell University. In this paper the author points out the many advantages possessed by mechanical draft over what is termed "natural draft," and various methods of producing mechanical draft are described. It is pointed out that the chimney as a means of creating a movement of air depends upon the heating of that air by which a difference in density is produced. The heat thus employed is wasted so far as its utilization for any other purpose is concerned. This inherent loss with an ordinary coal, the author states, amounts to about 20 per cent. when the gases are at 500° and the excess of air is 100 per cent. If, he says, in place of the chimney, there be substituted an engine-driven fan of proper size, the resultant of the efficiencies of the steam boiler, the engine and the fan, together with the loss by friction in the apparatus, may be taken at about 4 per cent. Therefore, the work done, or its equivalent in heat units expended to produce the given result, would be about 70 times as great in the case of a chimney as in that of a fan. The paper ends by showing the influence from a commercial standpoint the application of mechanical draft would exert upon a given steam boiler plant equipped with eight boilers of 200 nominal horse power each. This saving in first cost, were the chimney done away with and mechanical draft instituted, is shown to be $11,875. This would indicate an annual saving in fixed charges of about $831. A further saving of $126 a week in fuel would result owing to the fact that an inferior quality of coal could be used with the mechanical draft. In conclusion the author says: "Briefly summarized, mechanical draft has here been shown to be capable of reducing the avoidable losses, of decreasing the first cost of a steam generating plant and of reducing the fuel expense. In addition, it presents certain marked conveniences in the matter of installation and operation. In these days when every step in the process of steam generation and utilization is being scrutinized in the attempt to reduce the cost by even a single per cent., the opportunity presented by the employment of mechanical draft cannot be and is not overlooked."

* * *

Electric Cranes on Shipboard.

Electric motors have been adopted on shipboard but slowly. When first introduced their range of duty was comparatively limited, consisting principally in operating blowers for ventilating purposes, and their application to other uses was unquestionably hindered by the fact that until recently no special marine type of motor was brought out, while the ordinary type of motor was bulky and generally unsuited for the duties it would be called upon to perform. The North German Lloyd line was probably the first transatlantic line of steamers to adopt electric motors on anything like an extensive scale. Their two steamships, Darmstadt and Prinz Heinrich, were equipped with electrically operated winches which proved so successful that when the Bremen of the same line was completed it was fitted with sixteen deck cranes operated by means of electric motors. The thirty-two motors which run the cranes are supplied with current from direct-connected generators, of which there are four of 75 kilowatts each. Two dynamos only are required to operate the sixteen cranes, a third generating set being utilized for lighting, and the fourth is held in reserve. The controlling apparatus, including cranes and motors, is mounted upon a pivoted circular iron platform. The latter is made to revolve by means of a seven horse-power motor running at 700 revolutions per minute, directly coupled to a worm gear which in turn meshes in a gearing fastened to the deck. The total swing outboard on all of these cranes is 20 feet 6 inches. They have a lift of 16 feet 6 inches, the loads being raised by means of a twenty-five horse-power series motor which runs at a speed of 900 revolutions. Two special marine controllers about two feet in height serve to start, stop and regulate the speed of the motors. The mechanism is simplicity itself, for on raising a hand lever the load is raised, while on depressing the same lever the load descends. A movement of the lever either to the right or left causes the crane to turn correspondingly. To insure perfect control, two band brakes are provided, one for each motor, which are attached to an extension of the motor axle and may be operated by a slight pressure of the foot. Two sizes of cranes are in use on the steamer Bremen although both types are similar in form. The larger has a lifting capacity of three tons with a speed of about one foot a second, whereas the smaller has a lifting capacity of but one and one-half tons with a speed of almost two feet a second. In other respects the two sizes are identical and closely resemble each other.

There are many advantages attending the use of electric cranes such as the above on shipboard. One of their most remarkable features, and one that is much to be desired, especially on a passenger ship that is obliged to touch at different ports and unload freight, is their noiselessness of action. Another feature which highly commends them is their simplicity of operation and the ease with which they may be controlled by even the most stupid laborer. Electric cranes are moreover much neater in general appearance and far more cleanly than the crane operated by steam. In all these cranes the electrical mechanism is thoroughly protected against inclement weather, is dust proof and arranged in such a manner that sea water cannot penetrate to it. This type of lift having proven so successful after a lengthy trial on one of the principal transatlantic steamship lines, it should not be long before the electric type of crane is universally adopted for the purpose of loading and unloading our ocean grayhounds.

Under the Searchlight.

Notes and Comments on Various Topics.

THE Boston *News Bureau* of Saturday last, referring to the proposed reduction of the preferred stock of the General Electric Company, says: "Counsel for the committee of preferred stockholders of the General Electric Company have prepared a strong bill which will be filed within a day or two in the United States Circuit Court in Boston or New York, which bill will seek to prevent a carrying out of the directors' plan of a 40 per cent. reduction of the capital stock. The bill will not ask for an injunction restraining the holding of the special meeting called for August 10. The committee points out that the court's decision will be of far-reaching importance, as establishing the rights of minority stock interests in corporation affairs."

* * *

THE Madison (Ind.) Electric Railway Company has appointed five young women conductors on as many of its cars. In selecting the girls the manager seems to have given some attention to the euphonic quality of their names as the list will show. The chosen ones are named Lydia Martin, Addie Douglass, Beatrice Garlinghouse, Rosa Caplinger and Emma Meyer. It has been observed that since these youn women became conductors the cry, "No seat, no fare," has died out in Madison, there being no longer any scarcity of seats in the cars, as the men passengers apparently prefer to stand on the rear platform.

* * *

THE N. Y. *World* says it is "understood that J. P. Morgan and other General Electric men are interested in a street cleaning machine to be operated by electricity. Electrically propelled sweeping and loading carts are to be used. R. N. Beach and W. J. Clark of the General Electric Company are among the incorporators. Authorized capital $1,000,000." There will be a big heap of rubbish to clear away when the General Electric Company dumps its $4,000,000 of patents out of its office, and the electrical street sweeping apparatus of the new company might be tested on that job. If Clark is put in charge of it, he might be able to pick up stuff enough out of the musty refuse to reimburse him for the capital he has invested or expects to invest in the new company.

* * *

Can Lightning Strike Through Water?

An interesting fact has come to light regarding the recent explosion of three submarine mines in the Potomac river, which was brought about as was supposed by lightning having struck the switchboard or some of the connections. It now appears that neither the switchboard, cable or electrical connections show marks of having been struck, and General Wilson, who has been investigating the matter, believes, strange as it may seem, that one of the mines was directly struck by lightning through four feet of water and that the others were probably set off by concussion.

* * *

THE very latest development in field telegraphy and telephony consists in a two-horse wagon equipped with four folding tables which when thrown up form desks upon which are placed telephone and telegraph instruments. Batteries are carried beneath the seats, while coils of wire are so arranged as to run out as fast as the wagon is driven. Twenty such vehicles have been ordered by the Government and will be sent to the front as rapidly as possible.

* * *

THE editor of *Lightning*, London, says that he is in receipt of a communication from a lady in Constantinople saying that the reason for the backwardness of matters electrical in Turkey is that the Sultan cannot discriminate between dynamo and dynamite, the second of which he cannot endure.

* * *

Wanted the Frills.

We find the following in the Chicago *Post*:

Of course it didn't happen in Chicago, because we don't have such things here. It happened in a town where they have fenders on the trolley cars—fenders that are designed to pick up the incautious pedestrian, throw him up into the air two or three times and then toss him over the platform railing. Of course, they don't do that, but that is what the agent always insists that they will do, and some of them look as if they might. Anyway the old fellow with the carpet bag evidently thought so. He was standing in the middle of the track when the car came along, going at a rate of a mile a minute or less and clanging its gong at a terrible rate. But he didn't move. Consequently there was nothing for it but to put on the brakes or take chances of having to defend a suit for damages. The car stopped within about two feet of him.

"Get out of the way!" yelled the motorman.

"Come on, consarn ye!" roared back the countryman.

"Get off the track!" shouted the motorman angrily.

"Not much," retorted the countryman determinedly, "I'm waitin' fer ye. Why don't you come on?"

"Do you want to be killed?" demanded the conductor, coming to the front of the car to see what was the matter.

"No, sirree," returned the countryman. "I want to get aboard your blamed old car."

"Well, come on, then," said the conductor, indicating the step at the side of the platform, but the countryman only shook his head.

"You can't work it that way," he asserted doggedly.

"I'm down here to see the hull town, an' you bet I want all the frills. Come on an' hist me now, an' be quick about it."

"H'ist you!" exclaimed the conductor. "Are you crazy?"

"No, I ain't," was the indignant reply, "but I reckon I know my business and can't be put upon by any dern street car man that lives. I've heerd all about your luxurious way of doin' things in the city, an' while I have money in my pocket I'm going to have all the frills an' fixin's there are. You jest come ahead with that there scoop an' pick me up an' put me aboard jest the way you do fer swell city folks or I'll report you to the boss, ding me if I don't."

In another minute he was lying in the wire netting yelling like a Comanche, while the car continued its journey, still at the rate of a mile a minute or less.

* * *

AT Centreport, L. I., a prominent resident recently held a rather novel entertainment for the benefit of the local church in the way of an electrical festival. Electric light wires were run all through the grounds, from which were suspended numerous electric lamps which brilliantly illuminated the dancing platform and rendered the scene very picturesque and attractive.

* * *

Petroff or Sir Humphry Davy?

Who was the first to discover the electric light? Our belief up to the present time has been that it was Sir Humphry Davy, in 1813, but *il faut changer cela*, as it now appears that it was Vassili Petroff, a Russian professor, who accomplished the deed in 1802. This is what we read in a note in the Russian edition of the "Cours d'Electricite," by Eric Gerard, which has been inserted by the translator, M. A. Chatelain, who calls it an historic rectification. Almost all the electrical books published on the Continent tell us that Sir Humphry Davy discovered the electric light in 1813, and no one will hesitate in acknowledging that Russia is rather slow in recognizing the services of her scientists, since it took her not less than 96 years to become aware of the existence of the 2,400-cell battery which allowed Petroff to strike the electric arc before Sir Humphry Davy.

THERE SHOULD BE A HOT TIME IN SCHENECTADY ON THE 10TH.

We herewith publish verbatim the interesting document recently issued to the stockholders of the General Electric Company:

SCHENECTADY, N. Y., July 11, 1898.

To the Stockholders of the General Electric Company:

At the last annual meeting of stockholders, held May 10, 1898, the stockholders passed the following vote:

"*Resolved*, That the interests of the stockholders require that any proper or necessary adjustment of the impairment of the capital of the company should be promptly made, with a view to the early resumption of dividends."

At that meeting your Directors stated that while other values were in their opinion conservatively fixed, a revaluation of patents, franchises and good will (which have been kept on its books at substantially $8,000,000 since the organization of the company) should be considered at the proper time.

Your Directors are advised by counsel that in consequence of the impairment of its capital the company is forbidden by the laws of New York to pay any dividend whatever until the amount of such impairment shall have been regained, or until the nominal or share capital stock shall have been reduced to the amount of the actual capital.

Under existing New York law, the nominal or share capital of the company may be reduced at any time by a vote of a majority in interest of all the stockholders, and counsel advise that if any reduction be made the common and preferred shares must be reduced alike.

In view of all the foregoing, your Directors regard it their duty to urge the stockholders to make at once such reduction of the nominal or share capital as shall permit the payment of dividends upon both classes of stock with the least practicable delay.

Appended is the consolidated balance sheet of the company of January 31, 1898 (being the close of the last fiscal year), as it appears in the last annual report of the company. Your Directors, being of the opinion that the valuation at which patents, franchises and good will were carried in this balance sheet—namely, $8,000,000—was excessive, and that the fair and reasonable value of this item is the sum of $1,000,000, have by resolution directed this item to be reduced to that amount upon the books of the company as of June 30, 1898. Taking into account the estimated earnings of the company to August 10, 1898, your directors believe that a reduction of the share capital of the company as of August 10, 1898, to sixty per cent. of its present amount would make the share capital of the company substantially equal to the amount of the net assets which will then be on hand over and above the debts and liabilities of the company. Any surplus net earnings from and after that date will then be applicable to the payment of accrued dividends on the preferred stock and future dividends on both classes of stock.

Your Directors request the stockholders of the company to attend a special meeting to be held at the office of the company, at Schenectady, N. Y., on the tenth day of August, 1898, for the purpose of voting upon a proposition to reduce the company's share capital to 60 per cent. of its present amount as set forth in the accompanying notice. After such reduction each stockholder will hold, for each five shares of stock which he now holds, three shares of the reduced stock of the same class. Your Directors recommend that such reduction of the share capital of the company to 60 per cent. of its present amount be made.

Stockholders who favor the proposed reduction of the capital stock, but are unable to be personally present at such meeting, are asked to sign and return the enclosed proxy at once in the enclosed envelope, addressed to M. F. Westover, Schenectady, N. Y.

By order of the Board of Directors.

C. A. COFFIN, President.

M. F. WESTOVER, Secretary.

A revenue stamp is enclosed to be affixed by you to any proxy you may give. If not used please return the stamp.

Under date of July 28 the committee of preferred stockholders issued the following announcement, which sets forth their idea regarding the proposed reduction in preferred stock:

The committee named in the agreement dated June 1, 1898, between the committee, the American Loan & Trust Company and the depositors of preferred shares, are divided upon the question whether it is for the best interest of the preferred stockholders to acquiesce in the reduction of their shares by 40 per cent., as proposed in the circular signed by the President of the General Electric Company, dated July 11, 1898, Mr. Carr being in favor of accepting the proposition, and a majority of the committee opposed to it. The majority have determined to vote against it and if possible to defeat it by legal proceedings.

Mr. Carr has accordingly resigned from the committee, and the shares represented by him and others as trustees or executors will not be deposited.

Owing to this change of circumstances the remaining members of the committee think it proper to assent, and do hereby assent to the withdrawal by anyone desiring to do so of his shares deposited with the American Loan & Trust Company, upon signifying to said trust company in writing his desire so to do, on or before August 6, 1898, and remitting to said company 12 cents per share, which is the proportionate part of the expenses which have already been incurred.

The shares so withdrawn will be returned to the depositors as soon as possible after the opening of the books of the company.

The undersigned invite the continuance of the deposits of shares already made, as well as further deposits of preferred shares under said agreement of June 1, 1898, with the American Loan & Trust Company, by all who are disposed to join in resisting the proposed reduction of the preferred shares, calling attention to the fact that the liability to expense is limited to one dollar per share plus stamp for transfer as required under the revenue law.

Those who have not yet deposited their shares can do so by mailing to the American Loan & Trust Company the agreement which has already been sent with a circular to preferred shareholders, signed and stamped with a 25 cent revenue stamp (striking out Mr. Carr's name), together with their certificates of stock indorsed in blank.

(Signed) THOMAS L. LIVERMORE, EDWIN F. ATKINS, } Committee.

Help to fight the Electrical Trust by subscribing for ELECTRICITY.

SOME NOTES ON THE ELECTROLYTIC REFINING OF TIN AND THE RECOVERY OF TIN FROM ITS ORES.*

BY SHERARD COWPER-COLES.

Electrolytic methods have recently been applied to the refining of tin, Claus having taken out a patent in which he describes the use of an alkaline solution or compound of solutions containing sulphide or sulphides used for dissolving tin by passing an electric current through anodes cast from the crude tin to be refined. The solution is composed preferably of one part of stannate of sodium and two parts of water. The best results have been obtained from a sulphostannate of sodium (SnS_3Na_2) of specific gravity of 1.070, and heated to approximately 90° C, the current density being approximately ten amperes per square foot of anode surface. The residual metals or other material, except antimony or arsenic, contained in the anode are precipitated as sulphides, together with those metals or residue which are insoluble in the electrolyte. In the case of the metallic tin containing antimony or arsenic, or both, the deposited metallic tin is made the anode in a second bath, which is composed of dilute hydrochloric acid to which hyposulphite of soda has been added, the arsenic and antimony being precipitated as sulphides. Claus has also patented the use of a solution of sulphide of sodium of sp. gr. 1.065; gold, silver, zinc, lead, copper, antimony, iron, etc., remaining insoluble in the anode mud, some as sulphides and some in the metallic form. In some cases the inventor finds it preferable to use hydrate of sodium or potassium, and, instead of smelting the ore and using the alloy as the anode in the electric bath, he finds it more convenient to prepare the sulphostannate of sodium solution by fusing the ore with a proper proportion of sulphur and soda or sulphate of soda and carbon, and lixiviating the mass, or by boiling the ore or other material containing tin in a solution of hyposulphide of sodium and in converting either a part or the whole of the sodium sulphide in the solution into sulphide of ammonium, preferably by sulphate of ammonium or other salts of ammonia, the tin being deposited by an electric current, any copper, bismuth, zinc, etc., present in the tin anodes is recovered in the anode mud. The same method is employed for the treatment of tin ores as that described in the first records of tin smelting, only small improvements having been made in minor details. Attempts have been made from time to time to try and win the tin from the ore by electrolytic treatment. Processes hitherto devised have not been successful on account of the difficulty of finding a suitable solvent for the tin oxide. Dr. Burghardt has proposed treating tin ores electrolytically as follows: The tin ore is first crushed to a powder, to which a sufficient quantity of carbonaceous matter, such as coal or charcoal, is added, varying from 3 to 7 per cent. by weight. A quantity of caustic soda or potash is heated in the vessel without the addition of water, and the mixture of ore and carbon is added to the fused caustic soda, the proportion of caustic alkali being about twice the weight of the ore to be treated. The contents of the vessel are thoroughly stirred until the ores become dissolved and enter into chemical combination with the caustic alkali. The gases driven off by this process are chiefly carbon monoxide and carbon dioxide. The heat is increased until the carbon monoxide ignites. In the process of smelting, the oxide of tin is reduced momentarily to the metallic state; the metal thus formed is at once dissolved in the melted caustic soda or potash forming stannate of sodium. The combination of the ore and caustic alkali having taken place, the contents of the vessel are poured out to cool, and the resulting mass is broken up and dissolved in a suitable proportion of

* From the *Electrical Engineer*, London.

water; the solution is used as a bath in which the tin is obtained by electro-deposition. Vortmann and Spitzer proposed melting finely-pulverized ore mixed with from two to three times its weight of a mixture of one equivalent of sulphur and two equivalents of silver. Air is excluded through the fusion, which results in the formation of a triostannate. This salt is then washed out and the solution is allowed to settle. After the addition of ammonia and ammonium sulphate the clear liquid is electrolyzed with insoluble lead anodes. Classen has also proposed a somewhat similar process for the electro-deposition of tin. The electro-deposition of tin has always been a matter of some difficulty, as the tin has a great tendency to come out in the form of trees instead of in an adherent mass. The electrolyte devised by Roseleur has been used to some extent. The bath is composed of 5,000 parts of distilled water, 50 parts of pyrophosphate of sodium, or potassium, and six parts of protochloride of tin, and is made by placing the pyrophosphate and water in a tin-lined wooden tank, the lining serving as an anode, the stannous chloride being suspended in the liquid in a copper sieve. The first result is to produce a cloudiness in the liquid, which, however, subsequently becomes clear. After the complete solution of the tin in the salt the solution is ready for use. The tin anodes are incapable of keeping the solution up to its original strength in spite of the large anode surface, and small quantities of pyrophosphate tin salt has to be added from time to time. Tin bioxide dissolved in caustic soda has been used to some extent. Maitresse ensures the complete continuity of the tin covering obtained by electro-deposition by heating the coated object to the melting point of tin. All the solutions required for the deposition of tin require to be worked with a moderate current, the voltage being from three to five. The deposits have a dull, frosted appearance, similar to that obtained from silver cyanide solutions, but the tin deposited can readily be brightened either by scratch brushing or by friction of bran or by mopping with lime.

SWITCHBOARD APPARATUS.*

BY J. B. BLAIKIE,

Chief Assistant Electrical Engineer, Bristol, Eng.

(*Concluded from page 37.*)

AMMETERS.

Ammeters for the switchboard should be altogether different from laboratory instruments. The scale should be more accurately readable, at the lowest part, if there is any difference. On a rising load one cannot run too close to the capacity of a machine, while it is of the highest importance that one should know when the load has fallen sufficiently when switching out a machine. Again, when used on circuits, for perhaps 20 hours out of the 24, they are only indicating on the lower part of the scale. In practice they are often subjected to powerful external influences, since it is generally convenient to fix them close to the main omnibus bars. They should therefore be specially protected from such disturbances. The moving parts should be strong enough to stand excessive currents passing momentarily, and for many cases the movement should be damped.

An ideal instrument, if not quite dead-beat, might have a damping arrangement adjustable, so that the necessary amount could be applied under peculiar circumstances. An arrangement of terminals such that a standard instrument could be connected in series by means of flexible leads, to enable the instrument to be checked while in position, would be very convenient. Where a glass cover is used it should be far enough away from the pointer to minimize errors due to static charges on the surface.

The Edgewise pattern is becoming popular now for two reasons: it is more compact as a switchboard fitting, and when fixed in rows, and the index of each standing at a different value, you get a curve formed. The shape of this curve becomes more or less familiar to the attendant, so that he more readily notices a change which may point to an irregularity in the outside system. Ammeters for the exciting circuits of the machines are usually only required for alternators. To make intelligent use of these they should be easily readable through the range of the rheostat. They need not be readable below the minimum current required for excitation. They should be very accurate, well shielded from external influences, dead-beat and strong enough to stand rushes of current when the field is switched on or off.

It is impossible to pass over the subject of ammeters without drawing attention to the Weston instruments. To those not familiar with these, a summary of their advantages may be of interest. Unfortunately they are only suitable for continuous currents. The scale is perfectly uniform throughout the range. The action is remarkably dead-beat. The accuracy is very high, it is independent of external influences, and the calibration is not impaired by comparatively rough usage. The current measured does not pass through the instrument, so that it may be used on any part of the board, the connections being two small wires. It is really a voltmeter, measuring a minute difference of potential across a shunt which is placed in the main circuit. Any number of shunts can be connected by means of small plugs to one instrument. A pretty device, sometimes used with these ammeters, is a luminous scale. The scale is translucent, the gradation lines and figures being opaque. A small lamp fixed behind shows up the reading boldly, so that it may be seen at a distance. The recording ammeter is rarely used, and is perhaps an unnecessary refinement.

Integrating meters, ampere-hour or watt meters are hardly switchboard apparatus at present. They certainly would be useful adjuncts and will probably become general. The usual form of case may be an objection. If the makers would turn out something all over lacquered brass and a reasonable shape, there might be a development in this direction. The same remarks on ammeters with reference to calibrating with a standard instrument might be applied here. The roller form of register instead of dials, in a large size, which could be made of aluminum would be an attractive feature.

VOLTMETERS.

It is most essential that voltmeters should be accurate instruments. They must be sensitive to very small changes and for some classes of work dead-beat. They should be free from temperature errors and capable of continuously indicating the normal pressure for very long periods. They should always be protected by fuses easily accessible. Remarks on ammeters with reference to static charges on glass covers are applicable in some cases.

There are three distinct classes of voltmeters in everyday use—electro-magnetic, electro-static, and those depending on the expansion of a metal due to heat. The electro-magnetic are not available for alternating currents, generally speaking, and except for the purpose of recording instruments, where some power has to be expended in overcoming the friction of the pen on the paper, they do not possess many advantages. The Weston instrument, however, from its dead-beat action and extreme accuracy is again a favorite. As a voltmeter it can be fitted with a luminous scale, and it is usually provided with a movable index in the shape of a disk which eclipses a circular aperture in the pointer. This form of index is very easily seen from a distance. Electrostatic voltmeters are useless for recording, and some forms are liable to stick owing to the very small forces which actuate the pointer. They can, however, be used for alternating and continuous currents, and they consume a minimum of energy. They are most commonly employed for high tension work. Some engineers object to a dangerous potential across an instrument, especially as it has to be observed closely, and frequently tapped to insure a correct reading. A small sparking gap has to be introduced to protect the instrument, and with concentric mains a momentary rise of potential is common and causes the fuses to blow.

The familiar "Cardew" is a most useful instrument, being applicable for continuous and alternating currents and is very dead-beat in action. It gets out of adjustment rather too easily however, and is an awkward shape to accommodate on a switchboard. The horizontal pattern is much steadier than the vertical owing to the steadier rate of cooling. The consumption of energy is rather heavy. In spite of its many defects it is very popular, probably its wide open scale and sensitiveness compare very favorably with rival instruments.

Recording voltmeters are developing and may now render faithful accounts of electrical pressure. But from some points of view they are still imperfect instruments, since they may sometimes ignore the willingness of the spirit whilst testifying to the weakness of the flesh. Where these instruments are used the temptation to tamper with them should be removed, and the interpretation of the charts humane.

RHEOSTATS, MULTIPLE AND FIELD SWITCHES.

Rheostats are often suggestive of the skeleton in the cupboard. They are unsightly and the connections are frequently clumsy even though they may be sound. The choice of resistance material is a matter of great interest. Some alloys possessing excellent qualifications under laboratory tests have been found to have become rotten and brittle after a few years use, or they may suffer mechanical injury during construction either from bending, etc., or heat applied for soldering. Radiating surface should constitute one of the principal features of the design, ventilation being not an unmixed blessing as the more air you get through the rheostat the more dirt and dust is deposited. Compactness is desirable where it can be obtained without sacrificing other advantages. The displacement due to the expansion of the metal while hot must be provided for, and in forms other than the spiral this is rather an awkward matter. Spirals of wire are unsatisfactory since they are liable to shake together and interlock if accidentally displaced. They accumulate a lot of dirt, are inconvenient to clean and also involve comparatively confused connections to the multiple switch. Where a rheostat is only in the field circuit of an exciter and consequently small, it may be wound on a block of slate having a sliding connection along one edge. The slate absorbs a good deal of the heat which can then radiate from the larger surface. It is objectionable to have the contact on the actual wire, as the wear and any slight sparking might in time cause the wire to break. A great advantage, however, can be claimed from the fact that such an arrangement may be fitted on the board always in sight and kept thoroughly clean. An improvement on this form and suitable for larger work is effected by having special contact pieces fitted, and in the use of several small wires in parallel, whereby a large radiating surface is gained. Tubular resistances would be better still, introducing at the same time additional mechanical advantages.

With reference to multiple switches, besides ample current carrying capacity, there must be exceptional provision for wear as this may be very heavy. Circular switches or linear motion derived from a screw are most usual, but as there is a chance of the operator forgetting for the moment which way to turn the handle, it is preferable in the author's opinion to have a lever working through a quadrant in a vertical plane at right angles to the board, the connections being so arranged that the raising of the handle raises the voltage of the machine.

It is sometimes necessary to make fine adjustments and occasionally large alterations rapidly, so that a

* Read before the Municipal Electrical Association, London, June, 1898.

good regulating switch should have two handles, one having a number of intermediate steps between any two steps of the other.

Field switches should always be so arranged that they short circuit the windings at the instant of cutting off the current. The author is acquainted with two designs, one by Messrs. Siemens, the other by the Electric Construction Company, which are well suited for this duty.

SYNCHRONIZING APPARATUS.

In alternating current stations this apparatus is of first importance, and should be the object of the designer's special care and foresight. The possibility of a mistake on the part of the operator should be thoroughly investigated. The risk of breakdown in any part of the apparatus having been reduced to a minimum, provision should be made for replacing any defective detail within a minute or two, with no possible chance of reversing a connection, or there should be a simple method of throwing a spare set into circuit. There have been three or more methods suggested for synchronizing. First, two lamps, or one lamp and a voltmeter in series, off the secondaries of two transformers in series, the primaries being one on each of the pair of leads required to be synchronized. Second, a similar arrangement, having a telephone or buzzer to indicate the flow of current through the secondaries. Third, goldleaf electroscopes which can be used direct on 2,000 volt mains. The first method is almost always employed and it has the advantage of being easily seen by the driver, enabling him to adjust the speed of his engine. This information can also be obtained by lighting the station with alternating current arc lamps. When the armature is at the correct speed, the coil holders appear to be stationary or revolve very slowly forward and backward as the speed is too high or too low. It might be almost worth while to switch on a lamp in broad daylight when synchronizing for this purpose. Where alternate current arc lighting is adopted a goldleaf synchronizer could be used. It is more secure from breakdown for having no transformer. It is very dead-beat, but at present it has not been developed as a switchboard instrument, and requires modification to preserve the extremely high insulation necessary. While on the subject of synchronizing, it is instructive to notice that in English stations an artificial load on the incoming machine is considered unnecessary, although usually employed on the Continent.

In one English station it has been found advantageous to parallel machines through an impedance coil, and then short circuit the coil in two steps. As an extra precaution the paralleling of all machines, up to 400 KW. capacity, is done through a 20 ampere fuse, and this fuse is not blown more than once a month. (It may be mentioned that the armatures are of the coreless type.)

Having discussed the details, the general arrangement and construction of the board may be criticised. Slate or marble are usual as a base; but all holes should be bushed with ebonite, and ebonite plates fixed under all instruments for high tension work. There is a skeleton form, however, made of a lattice work of wood or angle iron on which the various instruments are mounted. This form is highly efficient from many points of view, but in appearance it is untidy, and it occupies a good deal of room. A recent development consists of a number of cells, made by vertical slate partitions fitted into slate shelves, which are built into the wall. In this arrangement there is of course no back, the connections being visible from the front, and carried up through a vertical series of cells.

The commonest form of board is constructed of slate slabs, or panels, having the instruments on the front and all connections at the back. It is the back of such boards that should be most closely watched. It is often necessary to change an instrument, or connect a new machine or feeder, and with high tension current at all points such work is frequently attended with great personal risk. Accumulations of dirt and dust have also to be removed periodically.

Such boards, if designed in a standard panel form, to permit extensions, should also have a standard system of back connections suitably protected, and in no case should miscellaneous cable and wire connections be allowed.

On double pole boards the opposite poles should be far apart, either horizontally or vertically. For the arrangement of omnibus bars and varieties of combinations some reasonable limit should be fixed.

Breakdown terrors are usually more prominent in the minds of high tension engineers, they may stimulate more careful design, but there is also a tendency to run to seed in a progression of combinations. It may be reasonable to have a means of dividing the main omnibus bars, and perhaps have a spare set, sometimes called "hospital bars," for the purpose of connecting any particular circuit, or any particular machine.

With reference to the relative position of the apparatus there is a decided preference for the complete set belonging to one generator, or one feeder being in a vertical line, well marked. It is also advisable to have the lines as close as possible in order that the effect of any adjustment can be watched in the other lines. This principle is so important that where some parts of the apparatus are necessarily large, it might be worth while adding auxiliary gearing to permit of concentration. It is of course essential that the handles of all the controlling gear should be within easy reach, and that the indications of all instruments should be accurately readable from a convenient position.

A necessity or temptation to lean or stretch over any portion of the board should never exist.

It seems almost absurd to mention such an obvious precept, yet it is common enough to find a clock which has to be wound periodically mounted on the top of a switchboard. There are boards protected on the front but this rather encourages carelessness and is often at the expense of safety at the back. By all means guard against every conceivable accident, but under the roof of a central station a board should be assured from wilful misuse or grossly ignorant handling.

A main switch, fuses or other safety device, and ammeter are among the first requisites of a panel, then there may be plug connections, synchronizing connections, field switch and rheostat switch. Voltmeters are usually common to the whole board, and here a suggestion may be borrowed from an American practice, in that of mounting a voltmeter on a swinging bracket from end of the board. It can then be moved to show to the best advantage at that part of the board where an adjustment is being effected.

Field switches may be advantageously mounted on the machine; by this arrangement there is a saving of conductors, and the man who lets down the brushes may be more confident that the machine is not excited at the time. For continuous current machines the rheostat and multiple regulating switch might also be mounted on the machine, or on the wall close by, thereby saving long conductors. Since the electrical pressure regulation is shared between adjustments of excitation and speed, both may be fittingly performed by one man, preferably the driver or dynamo attendant, whose attention can thus be directly called to the brushes at every alteration. Further it can be urged that fire risks are minimized by distributing the rheostats and situating them away from the wood platform or other such work in connection with the switchboard. In the case of alternating current machinery, the rheostat switches at least must be on the board or close at hand.

But there are some alleviations to compensate for the fire risks involved. Alternating current usually means high tension, and the heat generated is of use in keeping the board at a slightly higher temperature than the surrounding atmosphere. There are occasions, when there is a fog, or perhaps in the event of a mishap with steam connections, that this higher temperature may save condensation and consequent troubles.

One of the most pressing considerations in connection with the switchboard as a whole is the efficient protection from dust and accumulations of dirt, especially at the back. Not only should elaborate precautions be taken, but an easy and safe means of inspection and cleaning should be a prominent feature of the design.

From an æsthetic point of view a little license can be granted if all details are well designed. Wood mouldings and paneling add greatly to the general appearance. Some engineers severely cut down anything that is inflammable; this like everything else can be carried to excess. When one considers the proximity of such material to an open fire, in an ordinary dwelling-house, and the small risk one attaches to it, a little ornamentation on a switchboard appears to be reasonable. There is no necessity however to make a switchboard a subject for rococo decoration, and as mentioned before there are fitter places for a clock than in a surmounting scroll.

With a view to standardization another suggestion hails from America. One of the largest firms manufactures unit panels always on a standard size of slate. They make fourteen different capacities on a panel 48 in. by 16 in. by 1½ in. thick, and a blank panel 28 in. by 16 in. by 1½ in. to go underneath. They are bolted onto steel frames and adapted for unlimited extensions. The space required for a switchboard is not of such great importance if correctly estimated when designing the buildings. Too often however it has to go somewhere between two windows, in a cramped position, with little or no room for extensions.

The best position is probably on a gallery extending down the length of the engine room, except in belt or rope driven stations, in which case it should be parallel with the drives to be safe in the event of an accident with the gearing. An elevated position such that the operator can see and signal a driver at the stop valve of any engine is about the ideal.

Though perhaps a little foreign to the subject, a system of engine room signals might be conveniently touched upon here. It is too small a matter to be treated on under its own heading, but at the same time, it is important in the administration of duties from the switchboard. In large concerns a well organized system is indispensable, and in small stations, therefore, unorthodox signs should be considered as bad form. The practice of shouting and cat-calling about an engine room, though it may betoken hearty goodwill and enthusiasm among young assistants and pupils, is to say the least of it, undignified; such cries should be reserved for personal accidents. A regulation whistle or bell, which can be more clearly distinguished from the usual hum, should serve to call the attention of drivers. The number of a machine can be indicated by displacing a tablet having both sides painted the same. If the board can be seen from every stop valve, alterations of speed can be signalled by moving an extended hand and arm "up" or "down," the driver signaling the normal speed by moving his hand rapidly back and forward in a horizontal plane. Where the view is blocked different toned bells or a number of strokes may be employed, but it is remarkable to find how easily such signals can be forgotten or confused after being in daily use for months. Another method is to illuminate a small window, having a word painted on it, by means of a small lamp. Almost any method will answer the purpose provided that it is universal.

Turning once more to the question of standardization, manufacturers have now had the opportunity of gleaning from innumerable specifications, and of silently witnessing some failures. Perhaps a pyscho-

logical treatise on the switchboard attendant is still required.

There are without doubt some curious instances of irregularities due to absence of mind or fatigue. It is not at all uncommon to see a man feel the bearings and fill the oil cups of a standing machine, but when it comes to the switchboard attendant signaling "Raise speed" on a particular engine, the driver adjusting the governor of a standing engine, and the attendant signaling back "All right," the subject becomes decidedly interesting. Then there is the man with the laboratory training, who taps every instrument, including the clock and the almanac, before taking a reading. Fuses and plugs have been pulled out while carrying currents, and there was a story once of the exciting current being switched off an alternator while running in parallel. Possibly designers have already or can easily obtain sufficient information of this description for their guidance.

Once launched on this fascinating theme, ideas and suggestions spring up like mushrooms. In the interest of science let us suppress the prolificacy of imaginations, born of watching and wakefulness in the midnight hours.

Leave such work to professional designers who regard inspirations in the positive degree, and to men who live for "estimating," before whose searching gaze the colors and glories of originality pass and die away.

The author has endeavored to point out the necessity of good standard work for switchboards, and to discourage the individual of designing propensities among "resident engineers." He is aware that much has been done already towards establishing a standard, but has recently received replies to inquiries from several large manufacturing firms, "We have no standard, as we find all specifications differ."

It should be reserved for the resident or consulting engineer to judge, a representative body of engineers to frame rules and regulations, and for designers and manufacturers to perfect details and study economical production.

In conclusion, the author desires to express his thanks to the gentlemen and firms who have rendered him liberal assistance in the preparation of this paper.

ELECTRIC TRACTION.*

BY ROBT. C. QUIN, A.I.E.E.,
B. E. and T. Engineer, Blackpool, Eng.

It goes without saying that the subject of electric traction is so important and extensive that it is impossible to deal with it comprehensively in a paper of this description. The author proposes, therefore, to set forth as briefly as possible the salient points of the subject and to invite discussion upon them, rather than to detail at length any particular system or systems of electric traction.

Road.—In the author's opinion the road, or permanent way, is one of the chief factors which determine the success or failure of any electric traction undertaking, inasmuch as its condition will have a much greater effect upon the maintenance costs, and consequently, the financial result, than would probably be the case with any other system of traction.

Considerable difference of opinion seems to exist as to how this track should be constructed—whether the rails should be 43 lbs. per yard as upon the Giant's Causeway line, or 92 lbs. per yard as upon the Blackpool line—whether the gauge would be 3 feet or standard gauge.

The weight of the rail must of course be proportioned to the weight of the cars running thereon, and to the soil upon which the rails are laid; but it would appear to the author that the present practice errs too much on the side of lightness.

It will be admitted on all hands that smooth running is essential to the longevity of the rolling stock, and that this cannot be attained without rigidity of construction, smoothness of running surface and accuracy of gauge.

In order to ensure these desirable ends it is essential, in the first place, that the track should be well laid on a good solid foundation, accurately gauged and substantially cross-tied. The usual cross-tie for tramway purposes is a $1\frac{1}{2}$ in. by $\frac{1}{2}$ in. strap hammered round at each end and threaded and bolted through the web of the rails; but at Hamburg—at which place it has been the author's privilege to investigate the permanent way construction—things are done on a decidedly better plan. Here the rails, which weigh 106 lbs. per yard, are cross-tied by an I shaped girder, 4 in. deep, which passes under the bottom flanges of both rails, and is secured at each end by two substantial and adjustable chairs. These ties are placed about six feet apart.

The rails also are not butt jointed, but have a half-and-half lap joint, with a longitudinal cut through the web about 10 inches in length. The fishplates securing these are 2 ft. 10 in. long fastened by six $\frac{7}{8}$ in. bolts. The fishplate on the tread side of the rail passes under the bottom flange as far as the web.

This class of rail joint is one which, in the author's opinion, very nearly approaches the ideal. It has unbroken running surface, is rigidly constructed, and has a large rail to rail contact.

The cross-over roads at Hamburg are also of unique construction. At these points the groove of the rail is gradually shallowed until at the actual crossing point it is $\frac{3}{4}$ in. as against $1\frac{1}{4}$ in. at other parts of the rail. The flange of the wheel projects one inch; hence at these points continuity of running surface is attained by riding on the flange of the wheel.

Generator.—Shall it be high speed, slow speed, direct coupled, belt or rope driven; if with the latter shall the flywheel be placed upon the engine or dynamo? are questions which have been ably dealt with in the technical press by Mr. J. S. Raworth. On the question of flywheels, the author begs to state his opinion that the flywheel should be left at the factory, as there is quite sufficient flywheel effect in a tram car. The author further ventures to suggest that what is required is not so much uniform speed of the engine, or uniform E.M.F. of the line, as uniform motion of the tram cars, and in his experience neither of the former is absolutely essential to the attainment of the latter.

Slow speed engines, direct-coupled and belt-driven alike, are doing good service in traction work both in this country and on the Continent. But of these, so far as regards a modern plant, he cannot speak from personal experience. He has within his charge for lighting purposes, however, engines varying in speed from 80 to 5,000 revolutions per minute. The traction plant is of the latter order, i. e., direct-coupled, Parson's steam turbines, electrically governed. These turbines have been working since June, 1897, to the present time and seem well adapted for the purpose. Their efficiency is extremely good, the attention and cost of up-keep extremely small, while the automatic regulation is everything that could be desired.

The extent to which this range of regulation is called upon depends of course in a very large measure upon the weight of the cars, the number of starts per hour, the gradients, and, finally, the starting gear.

MOTORS—GEARING AND STARTING ARRANGEMENTS.

Motors.—The motors for traction purposes should certainly be of the enclosed type, as far as possible watertight, and their capacity such as to enable them on an emergency to develop, for short periods, at least three times their normal power.

The truck carrying the motor or motors should be rigid in construction, flexibility being given solely to the supports of the car body and of the motor.

The efficiency of a traction motor though of course an important point, is not of such great moment as with stationary motors. The question of weight as well as efficiency has to be considered; and the question after all amounts solely to how much power it will require to move the total weight of a car, equipment and passengers, a given distance at a given speed on a given length of track.

The efficiency again should be greatest at certainly not more than three-quarters of the maximum power of the motor, or preferably at its usual working load.

The arrangements for oiling should be such that while giving sufficient lubrication oil should not be able to obtain access to the inner portion of the case. Certain makers of traction motors now cover the bottom coil of the field magnet with sheet lead. This is a good preventive of failure due to the access of moisture, dirt or oil, but it would be better if these could be entirely excluded.

In the author's experience, the weakest point in a traction armature is at the junction of the winding and the commutator. Great flexibility should be allowed at that point, and the armature coils and laminations cannot be too rigidly fixed. The sudden starting with heavy loads on heavy gradients is very apt to spring the windings and snap their connection with the commutator.

There seems at present to be no settled practice as to the number of motors to be fixed upon a car. The author considers, however, that two motors should always be installed—either of which should be sufficiently powerful to take the car home in case the other breaks down. Further, that the starting arrangements should be such that the two motors are placed in series with a resistance and with one another at starting, and that under normal working conditions they should be in parallel, series wound motors of course being used.

The question of gear now appears to be reaching finality but it has passed through many phases. In the early days chain gear was generally adopted with doubtful success. Worm gear followed, but seems now to be gradually giving away before spur gearing.

The tram cars in the author's charge are at present all driven by worm gear. The worms are steel, $4\frac{1}{4}$ pitch, having three parallel threads. The worm wheels are gun metal. The whole is contained in an oil case; the worm is fitted with end thrust ball bearings. Worm gearing, if well fitted, is efficient, but the wear and tear are great, so that it does not long remain in an efficient condition. The worm gear is now being replaced by single reduction gear.

The nature of the controlling gear has an important bearing upon the economic working of a traction system. It has not only an immediate effect upon the revenue account but affects also the life of the motors and of the generators, not to speak of the comfort of the passengers. Moreover, with good controlling starting gear the maximum current taken momentarily by the car is considerably reduced, and with many cars working, and therefore many cars starting simultaneously, the amount of generating plant is most appreciably affected.

Within the author's experience cases have arisen under working conditions of the maximum current being eight times greater than the normal; this of course being with crude starting gear. If this maximum were not to exceed the normal by, say, 50 per cent.—and it certainly need not—the necessary amount of generating plant would be considerably reduced.

As bearing upon the question of the effect of controlling gear upon the life of motors, an incident which happened not very long ago may perhaps point a moral. A certain car, fitted with a series resistance and multiple contact switch as starting gear, stood upon a heavy gradient. The engineer in

*Paper read before the Municipal Electrical Association, London, June, 1898.

charge ventured to start the car, the immediate effect of which was to burn out a motor armature. On a second occasion under similar circumstances he again attempted to start, but this time burnt out the armature of one of the generators. But not to be beaten he repeated the operation under somewhat different conditions. The car was now equipped with a series parallel controller, the motors being the same. On this occasion he was successful as on all subsequent occasions when this experiment was tried.

Cars.—Double-deck cars are almost invariably used in England for urban tramway purposes. The practice, however, on the Continent is just the reverse. With the exception of Paris, single-deck cars seem to be the rule. The correct size of a car and the number of passengers it should carry are questions which cannot be settled until the conditions of traffic are known. If the line is double throughout a large number of cars can be conveniently worked. If it is a single line and loops the workable number of cars becomes limited, and their capacity therefore must be proportioned to the requirements of the traffic.

If the amount of traffic varies within wide limits during certain portions of the day, or at certain seasons of the year, it would appear to the author advisable to attach trailers to the motor cars at those times rather than to carry a heavy dead load of car weight the whole time.

While on this point the author would suggest that some better unit of efficient working might be established than the cost per "car mile." What is a car mile? Is it a trailer car carrying 15 passengers and weighing 3 to 4 tons; a motor car carrying 30 passengers and weighing 7 to 8 tons; or a motor car carrying 80 to 90 passengers and weighing anything up to 23 tons? He would suggest "ton mile" as a better unit.

System of Feed.—The preceding remarks apply with equal force to all methods of electric traction, but the most debatable feature in the question is the means to be adopted of conveying the energy from the generator to the motor.

The trend of technical as also of public opinion in this country appears to be in favor of overhead. It is, the author believes, admitted by all that it is the cheapest method, but some have qualms as to its sightliness and safety. These points it is obvious with a little skill and forethought can be easily provided for.

Strong posts of ornamental construction are now obtainable, and when used for the joint purpose of lighting the street and supporting the overhead conductor cannot be objected to by the most critical.

The overhead line must always be in evidence, but it is remarkable how accustomed one can become to it, so much so as not even to notice its presence.

The best means of ensuring safety is good work, first-class materials and sound construction. The gauge of the trolley line should not be less than 000 S. W. G., although 0 (B. & S.) appears to be the general thing on the Continent.

Two overhead conductors should be provided even for single line and loops, being, the author considers, cheaper in the end than spring frogs and other expedients.

Section blocks should not under any circumstances be placed in curves, also they should be provided (when trolleys are used) with guard checks to prevent the trolley wheel jumping the line when passing.

The span wire system of support appears best suited to high rates of speed, and is convenient in narrow streets where supports can be attached to the houses, but it necessitates a great number of straining wires at curves, which are not sightly.

The life of the overhead line is greatly affected by the class of contact making apparatus which is employed. Certainly the life appears longer with the rolling wheel than with the sliding bar. Whether the advantage which the bar has at curves and junctions sufficiently compensates for this, the author cannot say.

With a trolley line well erected and fitted with guard checks at cross-overs and junction frogs, there should be little risk of the trolley wheel jumping the line, but nevertheless such a contingency must be provided for. In the first place, the trolley head when free from the line should not be able to rise to any great extent from its working position. In the second place, should it happen that the trolley jumps the line when the car is proceeding at high speed and the head of the trolley locks against one of the supports (either bracket arm or span wire) something must give way. What will prove to be the weakest link cannot of course be given for certainty, but should it happen to be the trolley standard, accidents are likely to occur. The author suggests that it would be best to provide the weakest link in the shape of a loose trolley head, and that this trolley head should be anchored by an insulated cord to the trolley arm, say three feet from the top end. The only result then of the locking of the trolley head would be its dropping free from the arm.

It is necessary where telephone or telegraph wires cross the overhead conductor to provide some means for preventing these wires, in the event of their falling, from making contact with the overhead conductor. There are two ways of doing this: the first is to fix an insulator such as a wood or other moulding on the top of the conductor at those points; the second to suspend above the trolley line one or more guard wires. These latter seem to be preferable, as in practice the wood moulding works loose and makes considerable noise by vibration when the cars are passing. The guard wires should be stranded and capable of withstanding as great a stress as the trolley line itself. They should, the author also considers, be efficiently connected to earth. If this is so, a telephone wire coming in contact with the overhead line and the guard wire causes a short circuit and a cut-out at the generating station.

With overhead systems a rail return is almost invariably used, and therefore the question of bonding and of the earth circuit should be considered at this point.

For all practical purposes the conduction from rail to rail by fishplates and bolts must be neglected, and it becomes necessary to provide electrical bonds across these rail joints of the same equivalent area as the rail.

The rails the author is now using have an area equivalent to a square inch of copper. The bonds consequently should have this section. Under these circumstances it is preferable to use two bonds, as one of a square inch section would be inconvenient.

The heads of the bonds should have a contact area of at least 2½ square inches, and should be of such construction as not to render them liable to work slack. It is a good thing in calculating the fall of potential upon a given line to allow 20 per cent. for increased resistance due to the slackening of the bonds. Even with this bonding, unless the disposition of the gas and water mains has been carefully considered, the Board of Trade limit of stray earth current is likely to be exceeded.

If a gas or water main crosses the track or approaches the vicinity thereof, and from that point takes a shorter route to the neighborhood of the station earth than do the tramway rails, or has along that line of route a less resistance than the corresponding tramway return, it will take a greater proportion of current than is allowable; then, parallel to that gas or water main, an insulated conductor should be laid from the point of tramway rails above mentioned to the negative terminal of the dynamo.

Conduit.—The local conditions necessary for the successful working of a conduit system are, the author considers, freedom from sand and mud on the roads, good drainage and a wide slot. The conductor should not be visible from the surface of the street and should be frequently supported on insulators. It is necessary to have a wide groove in order to obtain an efficient form of collector or plough, as not only has it to contain the insulated conductors, but it must also be mechanically strong. The groove of the conduit should in all cases be parallel to the lines, and the conductor should not be co tinued across the points or cross-overs, as in these cases it would necessarily be exposed.

Generally conduits contain two insulated conductors, and this to the author seems preferable. It cannot be said that conduit systems have up to the present been successful enough to warrant their general adoption. Recently the author inspected four different conduit systems, but only two of these were then working.

The initial cost of a conduit system varies from 30 to 200 per cent. in excess of the cost of an overhead system, and the up-keep even where the conditions are favorable is about 10 per cent. greater than the overhead.

Accumulators.—The accumulator system of traction certainly possesses very great advantages, the principal of which is that the service of cars is not dependent on the maintenance of one system of feed, each car being entirely independent; but we have carefully to consider at what cost this independence is obtained. The crux of the whole question is the cost of carrying a useful load of passengers a certain distance, and for this purpose it is well to see how the question is affected by the adoption of storage cells. There are three heads under which additional expenditure is entailed—first, the interest upon the additional capital required for the installation of the cells and also their depreciation; second, the cost of propelling the additional dead load; third, the inefficiency of the cells.

With cars running all day with one charge the weight and cost of cells are both very great, as a comparison of the cars used in Dresden for overhead line only and of the cars at Charlottenburg for accumulators will testify. Dresden cars carrying forty passengers weigh eight tons; Charlottenburg cars carrying forty-two passengers weigh twenty-three tons. In both cases the useful load of passengers is approximately three tons. The cost of the accumulators used on the latter cars is about £750 per car.

The cost of traction accumulators varies from £75 to £125 per ton, the former figure being for rapid charging and discharging short-distance cells.

The author was much interested in the statements made by Mr. Epstein in his Institution paper (on the authority, he believes, of the Hanover Tramway Company) that the cost of the accumulator system of working there was only .2d. per car mile greater than the overhead system, and he must confess when making his recent visit to Hanover he did so with the intention of ascertaining how that .2d. was arrived at. To a certain extent he was unsuccessful, the cost of the up keep of the cells not being obtainable; but he believes that the figures which he has obtained are sufficient to effectually disprove that statement.

There is in Hanover one line of rather less than ten miles worked entirely by accumulators, the cars working that line being also equipped by the overhead, so that they are interchangeable with cars working on the combined system. They weigh 11½ tons and carry 36 passengers. The time occupied in running this journey exclusive of charging and stoppages is 45 minutes. The cells are charged at two stations en route, at one of which eight minutes charge is given at constant potential and at the other twenty-five minutes. The accumulators are placed under the seats, each car being fitted with 208 cells of Tudor type, and there are three plates in each cell. The weight of these cells is approximately two tons, and the installation cost of each car £200. The energy taken per car mile on this track was 1.5 units.

Although the up-keep cost of the cells was not ob-

tainable, the average life of the cells was given at about 18 months, and moreover additional cars have to be provided on the accumulator line as several cars are always occupied charging.

There is also another line at Hanover worked on the overhead system. Here the cars carry thirty-two passengers and weigh six tons. The energy taken per car mile of these latter cars was .68 units.

On the combined overhead and accumulator system, with cars similar to those in use on the accumulator line, the energy taken per car mile was 1.37 units.

Leaving the initial cost of the accumulators out of the question, there is the effect on the revenue account to be considered.

With rapid-charging low-capacity cells (which are really the only ones worth considering), the weight of cells for a five miles journey with one charge is about one ton for every 3¼ tons of car and passengers. Therefore with a car and passenger load of thirteen tons we must have four tons of accumulators. As every ton mile on a given road requires the same expenditure of energy, it follows that the energy given to the motors to propel this car will have to be increased approximately 30 per cent.

Opinions differ as to the efficiency of these cells, but generally the users of them consider that the watt-hour efficiency is about 60 per cent., and the author does not think the figure is far wrong. Therefore the energy of charging these car-carried cells has to be increased 117 per cent. owing to their inefficiency and weight. Further, the wear and tear of the road and cars is increased by the additional weight.

The life of the plates of the cells is variously given by the users as from one to two years, by the representatives of the makers as from two to three years; but the majority of the users do not find much difference between the li e of positive and negative plates. The cost of the up-keep of cells is given by the various tramway companies using them at from ¾d. to 3½d. per car mile, and the author thinks a fair average may be taken at 1½d. Assuming the cost of current to be .75d. per unit, and .7 of a unit to be taken without cells, figures the author does not think advocates of accumulators will cavil at, the cost of energy with the overhead system would amount to .325 penny, and with accumulators to 1.14 pence, or an additional cost of .62d.

This added to 1½d. for the up-keep of the cells per car mile gives us the additional cost of 2.12 pence, neglecting the extra wear and tear of the cars and road.

Now consider the capital cost. The overhead system per mile of double track costs complete, including bonding of the rails, steel posts (on span wire or bracket system) about £1,600. If these posts are used for street lighting purposes, the cost of the posts should be divided equally under the two heads, reducing the overhead cost to £1,000 per mile of double track; with a 2½ minute service and cars traveling eight miles per hour there will be six cars on the mile section, and, with the weight of the accumulators given, each car would cost £300 to equip, or £1,800 per mile of double track.

Again, if charging stations were adopted with say fifteen minutes charge, six additional cars would be required at an additional cost per mile of £560, making altogether a sum of £2,360 per mile.

With a slow service of cars the initial cost of the accumulators would probably be less than the overhead, but the additional cost of 2.12 pence per car mile (with only twenty thousand miles per car per annum) capitalized is equivalent to the sum of £3,530, bearing 5 per cent. interest for each car running.

COMBINED SYSTEMS.

Various combinations of the three systems before enumerated have been adopted. More generally it is a combination of the overhead line and accumulator system, but in all cases of which the author has cognizance, the adoption of accumulator systems has been not a matter of choice but of necessity.

When the necessity arises, the author would desire to point out most strongly that the dead load of the car in proportion to its useful load should be as small as is compatible with stability of structure. That arrangements should be made that the additional dead load of the accumulators is carried only so far as is absolutely necessary. It is therefore advisable to so arrange the battery that it can be detached as a whole from the car at the junction from the overhead line.

A great deal has been said from time to time as to the effect of the acid upon the cars and trucks, and of the odor of sulphuric acid which pervades the cars when the cells are placed under the seats. From what the author has seen of modern systems constructed on these lines he can give his assurance that these complaints are not well founded; and, if it were not for the inconvenience of detaching the battery as a whole from the car under these circumstances, he would certainly recommend the cells being placed beneath the seats.

Where the conditions are such as would permit of the working of a conduit system, and in the absence of permission to use the overhead, the author considers the combination of overhead and conduit much more preferable than the use of accumulators. The additional weight carried is negligible and the the working cost decidedly lower than with accumulators.

There have been many attempts to devise improved methods of electric traction, to obviate the disadvantages of the systems above enumerated, but they, one and all, have drawbacks peculiarly their own, which have hitherto prevented their general adoption. The names of these systems are legion.

The conclusions arrived at by the author all tend to the opinion that in the present state of electric traction engineering there is but one good and reliable and cheap system, and that is the overhead. Where a combination is necessary and conditions are favorable, overhead and conduit combined comes next in order of merit. That as at present constructed accumulators are not, from a commercial point of view, a satisfactory solution of the traction problem.

THE ELECTROCHEMICAL BEHAVIOR OF CHROMIUM.*

Chromium is a metal which until lately has been prepared in small quantity and a state of only approximate purity. It is now freely obtainable by reduction of its oxide in the electric furnace, or, better still, by the use of aluminum according to the method which has been the outcome of the experiments by various chemists, notably Vautin; this method has been put on a manufacturing footing at Krupp's works at Essen. Since chromium became procurable in the massive state Prof. Hittorf has investigated its electrochemical properties, and he has communicated an account of his observations to the German Electrochemical Society at their annual meeting recently held at Leipsic.

It might be expected on general chemical grounds that chromium would behave as an electro-positive metal similar to zinc, but Prof. Hittorf found that in dilute acid solutions in the cold not only is no hydrogen given off, but the chromium is electronegative to such metals as copper, mercury and silver. In the same way it fails to reduce such metals from solutions of their neutral salts and behaves generally as an inert "noble" metal. On making chromium an anode in cold dilute acids it indeed dissolves, but not with the formation of chromous or chromic salts; it passes at once to the state of chromic acid. The oxidation takes place quantitatively fairly in accordance with Faraday's law; the fact that the loss of weight of the anode is rather greater than the value calculated from the current passing is to be accounted for by the presence of impurities in the specimen of chromium used, which contained 3.5 per cent. of iron, about 0.1 per cent. of silicon and a trace of manganese; these foreign substances were probably derived from the aluminum used in the reduction of the chromic oxide to metallic chromium.

When chromium is made the anode in a fused salt as electrolyte, such as potassium bromide or zinc chloride, it behaves very differently. The metal goes into solution as chromous chloride, again obeying Faraday's law, but under these conditions dissolving three times as fast as in aqueous solutions. This behavior is evidently related to the property which chromium possesses of reducing salts, such as the chlorides of cadmium, lead and silver, when heated with them in the anhydrous state, while it fails to reduce them in aqueous solution. On raising the temperature of the electrolyte to 100° C. certain salts, even in aqueous solution, dissolve an anode of chromium as a chromous salt; such salts are barium chloride and ammonium chloride. Potassium bromide, cyanide and fluoride, on the other hand, dissolve a chromium anode as chromic acid at a temperature of 100° C. These remarkable alterations of behavior are most conveniently illustrated by the use of zinc chloride, which, on account of its great affinity for water and low melting point, can be caused to pass imperceptibly from a s ate of solution to one of igneous fusion. Thus, as the solution of zinc chloride is concentrated, its boiling point rises, and the chromium anode, which at the ordinary temperature dissolves as chromic acid, begins at 130° C. to dissolve as a chromous salt. [The author does not state whether at any intermediate point the chromium dissolves as a chromic salt.] A further curious observation is that, quite apart from its properties when used as an electrode, chromium which, as stated above, will not reduce solutions of the chlorides of copper, gold, palladium and platinum, even at boiling temperature, can be caused to do so by the addition of a salt of the class of potassium or sodium chloride. The smaller the quantity of this excitant which is added the more slowly does the reduction occur. Correlation with the electrochemical phenomena is established by the fact that only such salts as permit the dissolution of an anode of chromium as a chromous salt below the boiling point of the solution suffice to bring about the re duction; salts such as zinc chloride, which in aqueous solution at 100° C. still allow the formation of chromic acid from a chromium anode, do not act as excitants.

A natural outcome of these properties, which is nevertheless surprising at first sight, is that when chromium is made the anode in a hot solution of such a salt as KCl containing an easily reducible salt, viz., $CuCl_2$, metallic copper is separated *at the anode*. Rather more chromium is dissolved than corresponds with the current used, and it is presumably this surplus which effects the reduction of the copper. In short, the electrical arrangement, i.e., the use of the chromium as an anode, may be regarded as an artifice to induce the dissolution of the chromium to achromous salt, i.e., to act as a powerful reducing agent.

A study of the EMF. developed by chromium in KCl against Ag in $AgNO_3$ (with $NaNO_3$ as an intermediary) shows that at low temperatures, say 6° C. to 30° C., the EMF. is inconsiderable, but that it rises rapidly at 50° C., and at 100° C. is as high as 1.006 volts. The more dilute the solution of the electrolyte (KCl) surrounding the chromium the higher is the temperature at which a large increase of EMF. occurs. Returning to the chemical side of the question, one finds that certain of those salts which even at the boiling temperature are not reduced by chromium are reduced when the experiment is conducted under pressure, and the temperature of the solution is thus

*From the *Electrician*, London.

correspondingly raised. Thus at 225° C. $CuCl_2$ solution when heated with chromium deposits copper; at 195° C. $PdCl_2$ deposits palladium. Still more noteworthy is the tendency of the chromium when once it has been rendered active by any of the procedures given above, to persist in that condition after the *causa causans* has been removed. For example, when the galvanic combination $CrKClNaNO_3 AgNO_3Ag$, which is brought into activity by being raised to the boiling temperature, is allowed to cool, its activity may persist at the lower temperature. This persistence is more marked when the chromium is brought into contact with a halogen compound at a still higher temperature, e.g., chromium which has been exposed to the action of fused zinc chloride generally retains, although it has been duly cleansed, its capability of acting as an electro-positive metal, provided that the test be made with a galvanometer having a high resistance—30,000 ohms, for example. When it is allowed to yield a perceptible current, by cutting down the resistance of the galvanometer, it soon reverts to the inactive condition; the change is still more speedily induced by making the chromium the anode in an electrolytic cell.

The dissolution of chromium with the production of a chromic salt instead of a chromous salt on the one hand, and chromic acid on the other, which was adverted to above, can be accomplished by making chromium the anode in an alcoholic solution of zinc chloride at the ordinary temperature. With such a combination the chromium dissolves in close concordance with the requirements of Faraday's law, the electro-chemical equivalent of Cr for this combination being $\frac{52.5}{3}$.

The whole matter, as far as the facts are concerned, is excellently summarized by the author: Chromium can dissolve electrolytically in any one of its three states, according to the nature of the electrolyte and its temperature. Its inactive state, corresponding perhaps with the passive state of iron, appears to be the most stable of the three. The attainment of this passive state is not to be attributed to the presence on the metal of a thin layer of oxide, a hypothesis which is plausible for iron. It appears rather to imply that the surface at least of the metal differs in its molecular arrangement according to the conditions and surroundings to which it is exposed; in short, that chromium appears to be an allotropic element, using that much abused word for want of a better. The whole inquiry is of exceeding interest, and may we hope be profitably pursued by its present able investigator.

Meeting of the American Electro-Therapeutic Association.

The Eighth Annual Meeting of the American Electro-Therapeutic Association will be held on September 13, 14 and 15 at the Hotel Iroquois, Buffalo, N. Y. At this gathering a large number of important papers will be read, and an illustrated lecture on the X-ray will be delivered by Dr. Wm. J. Morton of New York.

An excursion for members, exhibitors and friends from New York to Niagara Falls and return, with stop over privileges at Buffalo, will leave the Hoboken Depot of the Delaware, Lackawanna & Western Railway on Monday morning, September 12, reaching Buffalo about 7 P. M.; a palace car will be attached. Tickets for the excursion, good for thirty days, to return on any regular train of the Delaware, Lackawanna & Western Railway, $10; seat in palace car, $1.50 extra. Tickets and seats can be secured from Dr. Robert Newman, 64 West 36th street, New York, from whom all particulars may be obtained. Early application should be made, for if a sufficient number can be secured a special train will be run. Special hotel rates at Niagara Falls will be secured for all excursionists.

LONDON NOTES.

[From our London Correspondent.]

Competition in Electric Lighting.

For some weeks past the English electrical world has been troubled with the question whether a municipal authority shall be allowed to set up electricity works and supply consumers in direct competition with an electric lighting company to which it allowed Parliamentary powers to be granted years previously. The Board of Trade allowed powers to two London Vestries for such a purpose and the shares of all the London electric lighting companies fell very heavily, and there was a good deal of concern as to what the future was going to bring forth. A Parliamentary committee having the final settlement of the matter has however since thrown out one of the orders, thereby leading to the opinion that after all competition was not to be allowed. In consequence electric lighting shares soon rose in value to about their former prices. Up to the present if a local authority has desired to go in for municipal electric lighting, it has had to purchase the existing works of a company at a very high premium, but there is now a very strong effort being made to render it possible for them to put down an entirely separate undertaking and compete with the company on its own ground. Such a course would, to say the least of it, not be just, as the companies secured their concessions years ago under the impression that they would have monopolies, and be bought out by the councils at any time the towns or districts desired upon special terms, or at certain periods upon better terms for the municipalities. One effect of the situation is a movement on the part of certain companies to endeavor to secure powers from Parliament to go into districts where municipal plants are operating and compete with them. There seems every prospect that such permission will not be granted.

Patent Litigation.

The Castner-Kellner Alkali Company, Limited, has just been claiming, before Mr. Justice Bigham in the Chancery Division of the London High Courts of Justice, an injunction to restrain the Commercial Development Corporation from manufacturing or selling any caustic soda or other alkali in infringement of the letters patent granted to Carl Kellner, No. 20,259, of 1894, for an alleged invention of improvements in electrolytic apparatus for decomposing metallic salts. The plaintiffs claimed damages for sales made under the infringement. The defendant company denied the infringement, and said that the alleged invention was not new or useful, and that it was not proper subject matter for letters patent. The letters patent were asserted to be invalid, and a number of patents were quoted in proof of prior publication. Mr. Fletcher Moulton, Q. C., Mr. Bonsfield, Q. C., and other eminent counsel whose names are generally associated with the great electrical patent cases, were for the plaintiff, and Mr. Terrell, Q. C., and Mr. Astbury, Q. C., and others appeared for the defendants. After hearing a great deal of technical evidence (among those appearing on one side or the other were Lord Kelvin, Mr. James Swinburne, Mr. Dugald Clerk, Mr. G. Grindle, Prof. C. Vernon Boys and Mr. Rhodin, inventor of the defendant's patent), the Judge said he would deliver judgment shortly.

Independent Telephone Association of Michigan.

The annual meeting of this association was held at Grand Rapids on the 26th ult.

The most important business of the meeting was the discussion of rates and the thorough review of the present situation of the wires of the companies of the State with especial reference to points between Muskegon and Indiana and between Grand Rapids and Detroit. A satisfactory conclusion was reached by the companies represented, so that it is entirely probable that active operations will be entered into immediately to complete the wires. Detroit was reported by E. H. Parker to have over 5,600 telephones in operation, with some 20 toll line connections on the New State Telephone Company's lines. This company is building several exchanges, the largest being in Jackson. Its long distance copper wire reaches Lansing this week and Grand Rapids soon. The Saginaw Valley was reported by R. F. Johnson with exchanges at Flint and Bay City; the Saginaw exchange will begin service with a total of 1,800 telephones. Grand Rapids reported 2,400 telephones and 282 State line connections; Kalamazoo, 700 telephones; Lansing, 650; Muskegon, 450. A large number of smaller exchanges bring the total number of independent telephones up to some 16,000, which is 2,000 more than the Bell Company has in the State.

Arrangements were made to connect the various toll systems together and also to connect with the Indiana and Ohio toll systems by long distance lines, and the prospects for Chicago and Indianapolis connections on or before January are favorable. The following officers were elected:

President—J. B. Ware of Grand Rapids.

Vice-Presidents—W. L. Holmes of Detroit, C. K. Monroe of South Haven, Geo. W. Finch of Escanaba.

Secretary—Alexander McLeod of Detroit.

Treasurer—W. H. Fildew of St. Johns.

Executive Council—The President, Secretary, Treasurer, F. B. Johnson of Lansing, R. F. Johnson of Saginaw, J. Williams of Adrian, Hugh Park of Muskegon, W. C. Osborne of Kalamazoo, P. H. Parker of Detroit.

At the meeting were present, in addition to the local exchange, representatives of all the larger exchanges and toll line companies, including those in the Detroit, Saginaw Valley, Lansing, Kalamazoo, St. Johns, Owosso, Oceana, Montcalm, Stanton and southwest sections of the State.

CANADIAN NOTES.

A proposal is to be made to the city council of St. John, N. B., to secure legislation to take over the property, privileges and franchises of the St. John Electric Street Railway Company, to be conducted by the city in the interests of ratepayers.

The project to produce power by the construction of a channel from the Welland to the Jordan river, Ont., has again been revived. Mr. Wm. Pearson, C. E., of Oswego, is said to have pronounced the scheme feasible from an engineering standpoint. The question of disposing of the power will now be tested.

The Canadian Pacific Railway Company having completed their new copper wire between Ontario and the Pacific Coast are now able to give better facilities, and consequently have reduced their rates 20 per cent. from Ontario to many of their offices in British Columbia.

Ex-Mayor Elliott, of Brantford, Ont., representing the syndicate which has undertaken the construction of the proposed new railway between Brantford and the city of Woodstock, has just been conferring with Toronto members of the syndicate respecting arrangements for an early start in building the road. D. A. Middleton, C. E., of Ottawa, has just completed a survey of the road, which traverses as fine a stretch of agricultural country as is to be found in Canada, and is particularly adapted for railway construction, the average per mile of cost of construction being about ten per cent. less than the ordinary estimate. The new line will be 26 miles in length. It is expected that active operations will commence on the 1st of September next.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LEGAL NOTES.

At Hartford, Conn., on the 26th ult., a transcript was sent to the Court of Appeals in the case of the Electric Car Company of America and Thomson-Houston Electric Company against the Hartford & West Hartford Railroad Company.

The Western Union Telegraph Company has secured from Judge Purnell at Raleigh, N. C., an order restraining the Railway Commission from enforcing its order of 1897 making the rate on messages 15 cents for ten words from point to point in North Carolina, and its order of the last month making the rate on messages 24 cents in case the company makes the sender pay for the revenue stamp. The restraining order was served on Railway Commissioner Abbott, and will be heard before Judge Purnell at Raleigh the first Monday in September.

The Cincinnati *Enquirer* of the 23d ult. contains the following: "Col. T. C. Campbell, Guy Mallon and other attorneys have been taking depositions in this city during the past two days in the case of Green, Joyce & Co. of Columbus, O., against the Columbus Central Street Railway Company. The object of the inquiry is to establish the ownership of $350,000 of stock in the street railway by the First and Second National Banks of this city. The stock is now in the names of Lee Anderson, a colored porter, and Edward Morgan, a colored messenger in W. E. Hutton's brokerage establishment on Third street. Both are entirely insolvent, and it is alleged that the banks named are the true owners of the stock. The Columbus Central Road is in debt to the amount of $200,000, and its assets are valued at $530,000. Under the statute of liabilities the banks can be held for 100 cents on the dollar if their ownership is proved. Thomas McDougall is representing the banks. Judge George B. Okey of Columbus has been appointed Master Commissioner in the case by the court in that city."

In Philadelphia on the 26th ult. two suits were begun in the Common Pleas Court by the city of Philadelphia against the Philadelphia Standard Telephone & Telegraph Company as principal, and the Chestnut Street Trust & Saving Fund Company as surety, to recover damages for the failure of the telephone company to put in operation within one year from the date of the approval of its plans, July 23, 1896, a system to accommodate 2,000 telephones in the city, and also for failing to construct, lay and maintain a system of cables, wires and electric conductors. The suits are brought on two bonds given by the telephone company, conditioned for payment of $50,000 each, with the trust company as surety, for the faithful performance of the contract entered into with the city.

Meeting of the American Society of Civil Engineers.

The Thirtieth Annual Convention of the American Society of Civil Engineers was held in Detroit on July 26, 27, 28 and 29. In the absence of Mayor Maybury, the Rev. C. L. Arnold made the welcoming address, in which he touched on what science had accomplished and cited instances of engineering feats as old as civilization itself, such as the seven great wonders of the world. The engineers and the members of the organization he had the honor to welcome were, he said, the executors of the dreams and theories of the past.

In the annual address of President Fteley he reviewed in a general way what had been accomplished in engineering, and especially in railway construction, etc., during the preceding year. The United States, he said, had only 41 per cent. of the railroad mileage of the world in '96, as compared with 43 per cent. at the close of the year in '92. The general tendency of railroad business during the past year had been toward increase of speed and safety, through the block system of signals, through the perfection of the equipment and through efforts to secure uniformity in mechanical devices. Notable progress had been made especially in the abolition of grade crossings. The development of cable and electric railways had been phenomenal, and compressed air as a means of locomotion had also come to the front, while the electric locomotive was no longer a matter of experiment.

He further touched upon the canal question and reviewed exhaustively bridge structure, hydraulic dredging, dock and water works construction, tunneling, sewer construction and the advance in the development of electricity producing plants and hydraulic engineering. The address was most enthusiastically received. During the Convention the following papers were read and discussed:

"Experiments on the Flow of Water in the Six-foot Steel and Wood Pipe Line of the Pioneer Electric Power Company at Ogden, Utah," by Charles D. Marx, Charles B. Wing and Leander M. Hoskins.

"The Determination of the Safe Working Stress for Railway Bridges of Wrought Iron and Steel," by E. Herbert Stone.

"Marine Wood Borers," by Charles H. Snow.

"Dredges and Dredging on the Mississippi River," by J. A. Ockerson.

"Reservoir System of the Great Lakes of the St. Lawrence Basin; its relation to the problem of improving the navigation of these bodies of water and their connecting channels," by Capt. Hiram M. Chittenden, U. S. A., with a mathematical analysis of the influence of reservoirs upon stream flow, by James A. Sedden.

"Three-hinged Masonry Arches: long spans especially considered," by David A. Molitor.

The social feature of the Convention was everything that could be desired, and several pleasant outings such as trolley and boat rides were enjoyed.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING PLANTS.

Cresco, Ia.—This town has just voted by a handsome majority to put in an electric light plant.

Duluth, Minn.—City Engineer McGilvray has submitted to the council an estimate of the cost of a 500 arc light plant. The estimate makes the cost per lamp for all night service at $55.42. His figures for labor, etc., are as follows: Assistant superintendent and electrician, $1,200; engineer, $1,080; oiler, $720; two firemen, $1,440; two linemen, $1,800; three trimmers, $2,160; coal, $6,250; carbon, $4,450; incidentals, $600; depreciation of plant, $4,450; interest at 4 per cent., $3,560; total, $27,710.

Eaton Rapids, Mich.—A. R. Welch of Chelsea has been granted a five-year contract to light the city with electricity. Thirty arc lights are to be furnished at $40 each per year.

Grand Forks, N. D.—The city council acting on a petition from two-thirds of the qualified voters has made an appropriation for the installation and equipment of an electric light plant.

Greencastle, Md.—The town council has granted George F. Bloser a franchise for an electric light plant, and he will form a company for the purpose of building and operating the plant as soon as possible.

Harriman, Tenn.—The workmen have finished setting the poles for the new electric light plant that is to furnich illumination for this town.

Livingston, Mont.—The electric light plant of this city was almost entirely destroyed by fire on the 24th ult. Loss, $32,000; insurance, $24,000. The plant was the property of the Livingston Water Power Company. It will be replaced at once.

Mt. Pleasant, Tex.—Davis Bros. are making arrangements to put in a 400-light dynamo and electric light plant in this place and expect to have the plant in operation by September 1.

North Manchester, Ind.—The North Manchester Electric Light Company has made a proposition to the town council to buy its plant, and the latter has the offer under consideration. The company proposes to turn the property over to the town for $23,800, payable in twenty semi-annual installments, with 5 per cent. on the deferred payments.

Pittsburg, Pa.—Morris Mead, superintendent of the Bureau of Electricity, promises something great in the way of an electrical display during the approaching conclave of the Knights Templars. Supt. Mead is at work on the designs for the display, and he says they will be of such a character as to surprise and astonish the visitors to the conclave.

Portchester, N. Y.—The Portchester Electric Light Company has completed its organization, and is having plans prepared for a plant to be erected as soon as possible. The capital stock of the company is $50,000.

Redlands, Cal.—The Redlands Electric Light & Power Company has issued $300,000 additional capital stock, making the whole issue $500,000. The increase was made for the purpose of paying off the obligations of the company and perfecting the works.

Sacramento, Cal.—The water is so low in the American river at Folsom that power for the operation of the dynamos cannot be obtained for the works there and the lighting and street car service of this city has been interrupted. The old local power plant has been brought into requisition and the cars and lights are kept going.

West Superior, Wis.—Mayor Dietrich has ordered that all the street lights of the Water, Light & Power Company and fixtures be removed from the streets. The clerk has been instructed to advertise for bids for the lighting of the city by arc and naphtha lights, it being the opinion that a great saving will result to the city as a result of this step. The action is taken by the mayor and the council as a result of the city and lighting company being unable to agree on prices for lighting the city.

STREET RAILWAYS.

Alton, Ill.—The promoters of the new electric road to connect Alton with East St. Louis and with some small towns en route, have effected an organization by electing the officers and directors as follows: President, C. E. Carroll, St. Louis; vice-president, J. A. Meblin, Cleveland, O.; secretary and treasurer, A. Hothaus, St. Louis; directors: the officers and W. M. Warnock of Edwardsville, and Manning Mayfield of Alton.

Anderson, Ind.—The formal transfer of the property of the Anderson Street Railway Company to the Union Traction Company was made on the 22d ult. by Congressman Henry. The consideration was $300,000. In this transfer the Union Traction Company pays $150,000 cash and assumes the bonded debt of $150,000. The latter has filed a mortgage to the Farmers' Loan & Trust Company of New York, covering the property. The amount of the mortgage is $600,000.

Bristol, Conn.—The town council has been informed by Vice-President Ingleson of the New York, New Haven & Hartford Railroad, that active operations are to begin at once towards equipping the Providence, Warren & Bristol branch of the road with electricity. The cars will be equipped with trolleys as preferable to the third-rail plan for this line.

Brooklyn, N. Y.—The Brooklyn Elevated Railway has begun running its new electric motor cars on its tracks through the city.

Buffalo, N. Y.—The State Railroad Commissioners have granted the Buffalo Valley Railroad Company permission to construct an electric railroad from this city to Java, 26 miles distant. The road will be equipped for freight and passengers. E. E. Felton, president of the Pennsylvania Steel Company of Steelton, Pa., is president of the company.

Canton, O.—The Stark Electric Railway Company has notified the city council that the work of construction is about to begin under the franchise which has been granted to it.

Clinton, N. Y.—The Sauquoit Valley Electric Railroad Company has made application to the board of trustees for permission to construct and operate a street railway in this village.

Dayton, O.—The franchise which was granted to the Dayton & Troy Railroad Company by the county commissioners has been revoked, the date fixed for a commencement having expired.—A new inter-urban electric railway company has been organized under the name of the Rapid Transit Company, and proposes to construct a line between Dayton and Xenia. J. W. Neff, of Xenia, is the vice-president and one of the leading spirits in the company.

Dallas, Tex.—Ex-Mayor F. P. Holland is reported to have made the announcement that "the most extensive scheme of electrical railways ever projected in the South or Southwest has been planned to radiate from Dallas to neighboring towns and cities within a radius of 50 miles. William H. McGrath, vice-president and general manager of the Dallas Electric Company, is now in Boston to interest capitalists and is said to have secured several million dollars cash ready for investment in the enterprise. Charters will be procured from the State for the construction of lines from Dallas to Fort Worth, 32 miles; Dallas to Waxahachie, 30 miles; Dallas to Denton, 30 miles; Dallas to Greenville, 30 miles; Dallas to McKinney, 30 miles. The Waxahachie line may be extended to Corsica, 54 miles from Dallas, and to Hillsboro, 75 miles, and the McKinney line to Sherman and Dennison, 60 and 75 miles respectively from Dallas. The men who have the enterprise in hand usually carry through anything they take hold of. Mr. McGrath represents in Dallas and Texas already approximately $10,000,000 of Northern financial interests."

Frederick, Md.—A preliminary survey of the proposed route of the Frederick, Thurmont & Northern Electric Railway, and a report thereon, together with an estimate of the cost, will be submitted at a meeting of the directors to be held in this city August 3.

Iowa, City, Ia.—An electric street railway will probably be built here at an early day as parties are figuring on the cost, etc., and the rapid growth of the city is an encouraging factor.

Jackson, Miss.—General Carnes, who has a franchise for an electric road here, left the city for Memphis a few days ago and on his return, within a fortnight, will, he said, give immediate attention to the building of the road so as to complete it before the expiration of the time agreed on with the city council.

Millbury, Mass.—The franchises for a new electric road from Grafton, through North Grafton and Millbury Junction, have been granted, and the work of construction will be begun at once. The line will be about ten miles long.

Nevada, Mo.—An electric street railway is being built here by an Eastern syndicate who are pushing the work so as to have cars in operation by the last of August.

New York.—The work on the new underground trolley lines in Sixth and Eighth avenues is being rapidly pushed. About three thousand men are now employed on the task, and they are divided in three shifts of eight hours each, so that there is not an hour, day or night, when the work is stopped. The officials of the road say they see no reason why at the specified time, September 15, the whole work should not be completed and the new system in operation.

Pittsburg, Pa.—The Penn avenue car barns of the Consolidated Traction Company were completely gutted by fire on the 24th ult. On the second floor were stored forty-eight winter cars worth $55,000. These were entirely destroyed. A special car intended by the company for the use of President C. L. Magee and private parties was being built in the car shops. It was about finished at a cost of $5,000, and was burned with three other special cars. The company's loss was about $175,000, but is fully covered by insurance.

Quincy, Ill.—Judge Allen of the United States Court at Springfield has issued an order granting a temporary injunction restraining the J. C. Hubinger Company from constructing or operating an electric railway in certain streets in the city of Quincy. The order was issued on complaint of the Quincy Horse Railway & Carrying Company.

Redlands, Cal.—Steps are being taken for transforming the present horse car line of the Redlands Street Railway Company into an up-to-date electric line. Bonds are to be issued for the purpose. H. Fischer, J. H. Fischer and O. H. Childs have purchased a controlling interest in the company.

Savannah, Ga.—The "News" says: "The movement toward a new street railway in Savannah seems to be taking definite form. New York parties, who are largely interested in electrical enterprises, are understood to be pushing the matter, and if the outlook appears satisfactory may come into the field and give Savannah the benefit of competition."

Stamford, Conn.—The Consolidated Railroad's branch line between Stamford and New Canaan has been changed to a trolley line and the steam cars have been withdrawn.

Tiverton, R. I.—There seems to be a general demand for an electric road between Tiverton and Seaconnet, and those in a position to know are of the opinion that the road will soon be built.

TRANSMISSION PLANTS.

Columbia, Pa.—The large dam of the Susquehanna & Tidewater Canal Company spanning the Susquehanna river at Wrightsville has been leased for ninety-nine years to the Mastic Water & Electric Power Company. The company paid $75,000 for the lease and have executed a mortgage for $400,000. The water wheels and motors will be located in a building along the canal. About $25,000 will be spent in repairing the dam. Power will be furnished to Lancaster, York, Columbia and neighboring towns.

Fresno, Cal.—The San Joaquin Electric Company's plant is unable to furnish power or light on account of the scarcity of water in the San Joaquin river. This is one of the largest transmission lines in the world. It was recently built. J. S. Eastwood, vice-president of the company, has returned from a trip to the power plant thirty-five miles east of this city. He found a great shortage of water in the mountains, as many of the streams have dried up. The snow has disappeared and the springs have quit running. The north fork of the San Joaquin, where the power plant is located, is low, and the big reservoir some twenty-five miles further back in the hills affords but little water. The company promises to make some arrangement to supply its customers with light, and it is believed it will take hold of the old electric light company's plant and put it in condition.

Lowville, N. Y.—The village board has granted a franchise to Lafayette Wetmore to set poles and string wires within the corporation limits for the purpose of supplying electricity for light and power. Mr. Wetmore proposes to erect a plant on the Beaver river at Belfort and transmit electricity to Lowville and other points. He intends to organize a stock company to carry his project into effect.

MANUFACTURING, ETC.

Fort Wayne, Ind.—The Fort Wayne Electric Corporation has been successful in securing the services of Mr. A. J. Churchward, so long connected with the Excelsior Company, as electrical engineer. Mr. Churchward is generally known throughout the United States on his great success with single-phase alternating motors and rotary transformers, his latest patented device being a unique brushholder which the Government has adopted as standard. The Fort Wayne people are to be congratulated. It is understood that so soon as their new factory is completed they will enter extensively into transmission work.

Middletown, Conn.—C. E. Dustin, who was at one time connected with the Schuyler Electric Company, is endeavoring to interest our business men in a plant for the manufacture of electrical supplies which he proposes to establish here if sufficient encouragement is offered.

Pittsburg, Pa.—The electrical equipment of what is proposed to be the largest copper-refining plant in the United States, now in course of erection at Perth Amboy, N. J., by the Raritan Copper Works, has been awarded to the Westinghouse Electric & Manufacturing Company.

Washington, D. C.—United States Consul Wilburn at Dublin, Ireland, writes that a Health Congress is to be held in that city in August, the subjects to be discussed being the disposal of refuse, water supply of cities, treatment of sewage, sanitary inspection, regulation of plumbing, etc. An exhibition of articles relating to public and domestic hygiene, sewage disposal, drainage, heating, lighting and ventilating apparatus, electrical apparatus, etc., is to be held in conjunction with the congress.

COMPANY MATTERS.

Mansfield, O.—S. N. Ford, one of the largest stockholders of the Card Electric Company, has been appointed receiver of that concern on motion of the Citizens' National Bank and others, whose claims aggregate over $25,000. The company was organized in 1893 with a capital stock of $100,000. It manufactured car motors and other electrical appliances. The receiver was authorized to continue the business, as there is considerable unfinished machinery at the works and orders amounting to about $20,000.

Harrisburg, Pa.—The steam and street railway companies of the State have been notified by the State Railway Bureau that they must report before September or they will be certified to the Attorney General's department as delinquents and made to pay the penalty of $5,000. Last year there were several delinquents and proceedings were taken against them. The Bureau has been notified by ex-Congressman James Kerr, of Clearfield, that the Northampton Street Railway Company, organized a few years ago by New York and Clearfield capitalists to build an electric railway between Easton and Bethlehem, has passed out of existence. It was capitalized at $200,000. On the 23d ult. Judge Simonton made an order on application of the Attorney General revoking the charters of the Crawford Junction & McKean Street Railway Company, Daguscahonda & Elk Railway Company, Clarion Railroad Company and Brockwayville & Daguscahonda Railway Company.

ELECTRICIANS IN THE WAR.

Peekskill, N. Y.—The 1st Regiment of Volunteer Engineers is now full and expects marching orders at any moment. They were hoping to leave on the 3d inst., but there seems now to be some doubt of this. Their destination, when called upon, will probably be Porto Rico. Col. Eugene Griffin is said to be very proud of his regiment, and would like them to take some active part in the war before it is brought to a close.

PERSONAL AND MISCELLANEA.

A Minneapolis dentist has been apprehended on a warrant issued on a complaint of the Minneapolis General Electric Company. It is charged that the dentist arranged connection with the main wires of the company so that the electricity for use in his suite of four rooms would not be registered by the meter. He had many appliances of an up-to-date nature which require power to operate them and he used electricity for that purpose. The small amount registered on his meter led to suspicions which an investigation proved were well founded and hence the suit. Under the new electrical law of the State such an offence is punishable by fine not exceeding $500, or five years in prison.

Oliver W. Kenney, superintendent of the Weston (Mass.) electric power station, was killed on the night of the 22d ult. The storm had disarranged the fire alarm system and Mr. Kenney went to the battery room of the town hall for the purpose of locating the difficulty. While there he touched a live electric light wire heavily charged. Death was almost instantaneous.

RECENT COMPANY ELECTIONS.

Bethel Electric Light & Power Company, Bethel, Vt.—Directors: S. M. Washburn, M. Moody, E. Davis, M. G. Safford, L. M. Heath, W. H. Creamer and Rollin Gilson.

City Railway Company, Wilmington, Del.—Directors: O. W. Clark, S. W. Colton, Jr., Preston Lea, E. W. Clark, Jr., C. Ford Stevens, W. W. Pusey and Thomas C. Barr.

Galesburg Electric Motor Company, Galesburg, Ill.—President, Fred Secord; vice-president, Robert Chappell; secretary and treasurer, Loren Stevens; directors: Fred Seacord, Wilkins Seacord, Robert Chappell, P. M. Johnson, B. F. Arnold, J. K. Mitchell, Loren Stevens, O. F. Price and George L. Price.

Harrisburg Traction Company, Harrisburg, Pa.—Directors: E. C. Felton, Edward Bailey, David Fleming, James M. Cameron, Benjamin F. Myers, Henry A. Kelker, Henry M. Kelley, E. Z. Wallower, A. G. Knisely, F. Eugene Walz, C. L. Brinser, S. F. Dunkie, George W. Reilly, Jr., E. W. S. Parthemore, T. G. Calder.

Colorado Springs Gas & Electric Company, Colorado Springs, Col.—Directors: Irving Howbert, J. Humphrey, F. H. Morley, J. A. Hayes, W. P. Bonbright, R. J. Bolles and W. J. Copeland.

Middletown Electric Light Company, Middletown, Conn.—President, D. Ward Northrop; secretary and treasurer, H. L. Mansfield; general manager, L. O. Whitney; directors: D. W. Northrop, W. T. Elmer, W. H. Barrows, H. R. Butler, James P. Stow, Henry Woodward and Henry L. Mansfield.

Orange & Passaic Valley Railroad Company, Orange, N. J.—President, Col. Charles A. Sterling; vice-president, William Scheerer; secretary and treasurer, John H. Ely.

Portchester Electric Light Company, Portchester, N. Y.—President, William E. Ward; vice-president, Addison Johnston; treasurer, William E. Ward; secretary, Walter Comly.

COMMERCIAL PARAGRAPHS.

It is something unusual for the maker of an incandescent lamp to be willing to guarantee the maintenance of initial candle power for 800 hours or for approximately one-half the life of the lamp. This however is what the Beacon Lamp Company of New Brunswick, N. J., are willing to do, as will be seen elsewhere by their notice in this issue. Furthermore, as this concern offers samples for testing, it must feel assured that it can accomplish what it guarantees. The Beacon Lamp Company also offers for sale something new in the way of a 2.75 watts lamp. Any persons contemplating purchasing incandescent lamps would do well to send the Beacon Lamp Company a trial order.

We would call our readers' attention to the advertisement of the Reading Electrical Manufacturing Company of 739 Penn street, Reading, Pa., which appears in this issue. This concern is prepared to sell gas and gasoline engines, dynamos or motors, voltmeters and ammeters—in short almost any electrical apparatus desired—at a very moderate price. Any one contemplating investing in apparatus of the above description would do well to write the Reading Electrical Manufacturing Company and procure their price list.

The American Impulse Wheel Company of New York state that they are making steady headway with their improved water wheel and that it is attracting considerable attention in this and foreign countries. The company report that they have the most satisfactory commendations in every instance and find business increasing rapidly. Besides wheels shipped to various parts of the United States and reported giving most favorable results, the company have wheels installed in Japan, France, Sweden and Scotland. Among contemplated large power and transmission plants in Canada, Utah, Montana and Minnesota, the wheels of the company are being given most serious consideration, and their adoption in several instances, as per advices now in hand, is confidently expected. The company claim they have all the advantages in their water wheel of the best heretofore in the market, with added improvement as the result of the latest scientific knowledge and test. They claim to spare no pains to perfect mechanical design and construction, together with the highest efficiency, and give special attention to regulation. Mr. Thorburn Reid is consulting engineer of the company.

INCORPORATIONS.

The Electro-Magnetic Weighing Scale Company, Sacramento, Cal.—to manufacture, buy and sell automatic electro-magnetic weighing scales, etc. Capital stock, $1,000,000. Directors: H. G. Smith, W. P. Owens, F. B. Smith and Edward Hanak.

The Paris Light & Power Company, Paris, Tex.—to manufacture gas and electricity for light, heat and power. Capital stock, $60,000. Incorporators: D. H. Scott, B. J. Baldwin, Jr., F. J. Record and John A. Porter.

The Union Electric Company, Camden, N. J.—to generate and sell electric current for heat, light and power. Capital stock, $6,000. Incorporators: H. George Lewis, Oak Lane, Pa.; Charles J. Hart, Sharon Hill, Pa.; H. G. Kepler, Charles H. Hagy and John F. McCarthy, Philadelphia.

The American Electrocure Company of Vineland, N. J.—to manufacture and sell electrical appliances for curative purposes. Capital stock, $100,000. Incorporators: Benjamin F. Ladd, Eli B. Hendee, George Davidson and others, all of Vineland.

The Spartanburg Gas, Electric Light & Street Railway Company, Spartanburg, S. C. Capital stock, $200,000. Incorporators: William E. Lown, George G. Day and Albert Leszynsky.

The Tippecanoe Electric Railroad Company, Monticello, Ind.—to construct an electric railway from Monticello to Rochester, to Fowler and to Covington—length 110 miles. Capital stock, $50,000. Incorporators: Monticello—Henry

Van Voorst, Laughry Bros., J. E. Hanneway, L. G. Gustauel, J. W. Jost, Emory B. Sellers, Martin Witz, E. R. Dye, William Spencer, E. R. Gardner, W. H. Hamelle, F. B. Hamston, C. C. Spencer; Buffalo, Ind.—F. A. Ewing, Owen Kitchen; Pulaski—C. L. Bader, S. March; Headlee—Dennis P. Teeter.

The Natchez Light, Power & Transit Company, Natchez, Miss. Capital stock, $200,000. Incorporators: Maurice Mase and others.

The Dayton & Northern Ohio Railroad Company, Dayton, O.—to build and operate an electric railway between Dayton and Troy, linking Chambersburg, Vandalia and Tippecanoe. Capital stock, $10,000. Incorporators: James Christy, Jr., H. E. Randall, W. C. Shepherd, F. J. J. Stout and C. E. Hoover.

The Union Electric Company, Bridgeport, N. J.—to conduct a general electric business. Capital stock, $6,000. Incorporators: H. George Lewis, Charles J. Harr, H. G. Kepler, Charles H. Hagey, Joseph F. McCarthy and Samuel H. Richards, of Bridgeport.

The Cleveland Electric Light & Power Company, Cleveland, Tenn. Capital stock, $10,000. Incorporators: W. W. Cunningham, Frank Spurlock, Foster V. Brown, John O. Ramsey and C. A. Danals.

The Indianapolis Storage Battery Company, Indianapolis, Ind.—to manufacture storage batteries, electrical machinery and horseless carriages. Capital stock, $100,000. Incorporators: Charles F. Smith, Loren S. Dow and Anthony J. Wilson.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED JULY 26, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

607,852. Brake. Ernst W. G. C. Hoffmann, Charlottenburg, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Dec. 29, 1897.

607,918. Crossover for Trolley Systems. Charles E. Davis, Chicago, Ill., assignor to the Link-Belt Machinery Company, same place. Filed Nov. 21, 1896.

607,919. Electric Tramway. Alfredo Diatto, Turin, Italy. Filed Dec. 1, 1896.

608,088. Insulated Rail-Joint. George A. Weber, New York City. Filed Nov. 5, 1897.

607,901. Car-Fender. Albert C. Woodworth, Providence, R. I., assignor to the Consolidated Car Fender Company, same place. Filed April 12, 1897.

607,954. Car-Fender. John W. Range, Providence, R. I., assignor to the Consolidated Car Fender Company, same place. Filed June 16, 1897.

607,977. Car-Fender. Warren W. Annable, Grand Rapids, Mich., assignor to the Consolidated Car Fender Company, Providence, R. I. Filed Jan. 10, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

608,109. Electric Light for Surgical Purposes. Willard E. Dow, Braintree, Mass. Filed March 26, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

608,013. Reversing-Rheostat. Imle E. Storey, Philadelphia, Pa. Filed Jan 29, 1898.

608,133. Means for Preventing Stray Magnetism in Dynamo-Electric Machines. John F. Kelly, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company of Massachusetts. Filed May 27, 1898.

608,134. Electrical-Circuit Controller. Robert Lundell, New York City, assignor of two-thirds to the Interior Conduit & Insulation Company, same place. Filed Feb. 1, 1898.

608,135. Commutator-Brush Holder for Dynamo-Electric Machines. Robert Lundell, New York City, assignor of two-thirds to the Interior Conduit & Insulation Company, same place. Filed Feb. 4, 1898.

608,137. Electromotor for Electrically Propelled Vehicles. Alexander Siemens, London, England, assignor to Siemens Bros. & Co., Limited, same place. Filed Nov. 18, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

607,994. Microphone. Thomas J. Howell, London, England. Filed Jan. 3, 1898.

608,076. Electric-Telephone System for Houses. Louis Piaut, New York City, assignor of two-thirds to Elias Koch and Alphonse Koch, same place. Filed Sept. 9, 1897.

MISCELLANEOUS.

607,830. Device for Operating Electric Switches. James H. Cary, Springfield, Mass. Filed Jan. 8, 1896.

607,921. Electrical Measuring Instrument. George E. Elphinstone, London, and Arthur C. Heap, Penn, England. Filed May 13, 1898.

607,984. Magnetic Ore-Separator. Gerald J. Crean, Montreal, Canada. Filed Jan. 7, 1898.

607,989. Interior Conduit. Eric E. Erickson and Frederick W. Erickson, Boston, Mass. Filed June 3, 1898.

607,992. Igniter for Gas-Engines. Ralph B. Hain, Grand Rapids, Mich., assignor to the Monitor Vapor Engine & Power Company, same place. Filed April 8, 1896.

607,997. Electrically-Self-Propelling Vehicle. Louis Kreiger, Paris, France. Filed March 11, 1897.

608,015. Secondary Battery. Georg Walter, Strasburg, Germany. Filed Aug. 19, 1897.

608,100. Annunciator Gas-Fixture. John L. Bixby, Arlington, Mass., assignor to Nathaniel Conant, Brookline, Mass. Filed Nov. 26, 1897.

608,104. Electric Sounding Device for Ships. John P. Buckley, New Orleans, La. Filed Dec. 11, 1897.

608,132. Electrostatic Measuring Instrument. John F. Kelly, Pittsfield, Mass. Filed April 14, 1898.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

TELEPHONE AND TELEGRAPH.

According to the statement of a railroad officer, the long distance telephone has ruined the business of one of the limited trains between New York and Chicago, and this, he adds, "is not surprising when it is remembered that the limited service was designed chiefly for those who were obliged to make quick business trips and could not afford to be absent more than a few days from their headquarters. With them time was money, but now they are able to accomplish their business over the telephone at a decidedly less expense than when they had to travel back and forth between the centers of trade mentioned. Therefore, they no longer have need of a fast train service. It is not the broker and the merchant alone who find the telephone a valuable means of quick communication. All the larger railroad systems are using the long distance wire and economizing time, while also not infrequently escaping vexation of mind and spirit due to misunderstanding and delay. Railroad officers who formerly were obliged to spend many hours on the road that could have been utilized to advantage in their offices, or had to use the telegraph wires, can now remain double the time in their offices that they did and talk with subordinates along the line, securing from personal conversation over the long distance 'phone much more prompt and satisfactory results."

The decision of the United States Circuit Court in the case of the Western Electric Company vs. the Millheim Electric Telephone Company et al., of Pennsylvania, in favor of the complainant, is being exploited as a great victory for the Bell Company as it sustains letters patent No. 449,106, issued March 31, 1891, to John J. Carty of the New York Telephone Company for a bridging bell on party lines. The defence was lack of novelty and patentability. This decision, however, is of minor importance, and only affects some small independent telephone companies operating in rural districts where more than two instruments are connected in a single telephone circuit. These have been obliged to use the bridging bell in order to give satisfactory service to their subscribers. In large cities or thickly populated districts the decision will have no bearing, as independent companies have found it more economical to furnish each subscriber with an independent line, or to connect at the most two instruments in a single circuit. The Millheim company is but a comparatively insignificant company, and was probably unable to put up much of a defence, nevertheless the case will, we understand, be carried to a higher court.

The Chesapeake & Potomac Telephone Company of Washington, D. C., has a number of suits on its hands because it refuses to supply service at the rate ($50) prescribed in the bill making appropriations for the District of Columbia, which was passed by Congress at the recent session. The law took effect July 1. One of the suits has been heard by Judge Hagner and taken under advisement. The telephone company set up as the grounds for refusing to observe the law: 1. That it was unequal and unjust in its operations, compelling every subscriber to pay the same amount for his telephone, irrespective of the use he made of it. 2. That it applied only to the telephones used by the District Government, not to those of the public generally. 3. That it violates the constitutional guarantee against the confiscation of property, in that the rate prescribed will not pay operating expenses and a fair return on the investment of money in the plant.

To obviate the use of the usual conductors in burglar alarm systems for safes, vaults, etc., Mr. Clyde Coleman of Chicago has invented a system of employing Hertzian waves. In accordance with this invention, the connecting conductors are entirely dispensed with and a transmitter is provided in the protected structure which is thrown into operation immediately upon any tampering with the protecting barrier, so as to produce a series of vibrations capable of transmission through the intervening medium to actuate a cohering receiver at the alarm station. The receiver closes the local alarm circuit, causing the bell or other means to produce a signal, until the attendant stops it by decohering the particles between the electrodes.

The Kinloch Telephone Company has begun operating in St. Louis. An officer of the company says: "The number of 'phones in use will be increased gradually, as the girls become proficient, until by September 1 we will have 5,800 in operation. The Kinloch Company has laid 331,000 feet of underground cable, strung 436,000 feet of aerial cable, and used up 2,270 miles of copper wire. We have up to-date 5,800 subscribers, and 4,082 telephones have been connected and are ready for use when the switchboard is operated. The switchboard will be handled by 115 central girls. We have 246 men employed in the cable work, and 430 working in the basement and constructing the switchboard."

The Hudson River Telephone Company has completed a very important addition to its system in a new line which runs from Albany to Cobleskill, passing through the villages of Berne, Gallupville and Schoharie. A branch runs to Middleburgh, though the main line goes through Central Bridge, Howe's Cave to Cobleskill. Another line runs by Thompson's Lake, passing through Delmar, Normansville, Clarksville and East Berne. As this is the first line running through these villages it is expected to be of great service to the business portion of the community.

The Atlantic Coast Telephone Company, which was recently granted permission to run its wires in Atlantic City, N. J., in opposition to the Bell Telephone Company, has completed its organization by electing the following officers: President, E. L. Reinhold; treasurer, Louis Kuehnle; directors: E. L. Reinhold, James B. Reilly, H. Burdcassel, H. L. Heldman, Louis Kuehnle. The company expects to rent 'phones at about $20 per annum. The work of construction will begin shortly.

The Tyson long distance telephone between Savannah, Ga., and Macon is completed, and the line is ready for business. Among some of the towns reached in the trade territory of Savannah are Bloomingdale, Meldrim, Blichton, Arcola, Statesboro, Summit, Graymont, Hillburn, Dardenville, Swainesboro, Stillmore, Covena, Rentz, Rixville, Crooked Run, Lothair, Mt. Vernon, Adrian, Odomville, Ethel, Kite, Wadley, Bartow, Louisville, Dublin, Spring Haden, Dexter, Jeffersonville, Danville, Wrightsville, Lovett, Kennell and Sandersville.

A San Francisco dispatch states that it is reported there that a contract for laying a cable between the United States, Hawaii, the Ladrones and the Philippines has been let and that communication over it will be possible within a few months. Most of the surveys have been made except some soundings between Hawaii and the Ladrones.

The Columbia (Pa.) Telephone Company at its annual meeting elected the following officers and directors: President and general manager, H. O. Young; secretary Frank G. Paine; treasurer, H. F. Yergey; superintendent, Harry W. Johnson; directors: M. R. Hoffman, H. F. Yergey, A. W. Geiskie, Charles Rochow, Joseph Loder, Frank G. Paine and Harry C. Young.

At a recent meeting of the city council at Columbus, Ga., an ordinance was introduced and read the first time, the effect of which will be, if passed, to give a telephone franchise in Columbus to E. W. Coleman. Mr. Coleman is a North Georgian, who proposes to put in an independent system at Columbus in opposition to the present system of the Southern Bell Telephone Company.

The equipment and franchises of the East Tennessee Telephone Company, located in Knoxville and East Tennessee, have been mortgaged to the Nashville Trust Company. The mortgage is for $150,000. It is not known to outsiders to what use the company proposes to put the money.

The Paterson, Passaic & Suburban Telephone Company, a rival of the New Jersey & New York Telephone Company, has started preliminary work in Passaic and promise to have several miles of subways completed in that city before the end of the year.

The Mutual Telephone Company of Des Moines, Ia., has made a contract with the Sterling Electric Company of Chicago for a new switchboard which will have a capacity for 2,000 subscribers.

Dowagiac capitalists will establish a new telephone system at Niles, Mich., to compete with the Bell company. The system will be first class in every respect and will be connected with the independent long distance line.

There are four applicants for franchises in Perioa, Ill.—the Central Union Telephone Company, the Fulton County Telephone, the Automatic Telephone Exchange Company and another.

A local telephone company is to be organized at New Richmond, Wis., at once, and it is expected that about seventy-five phones can be put in.

A franchise to erect and operate a District Messenger service, Fire and Police Telegraph, at Dallas, Tex., has been granted to O. J. Gorman and associates of that city.

New Companies Incorporated.

The People's Telephone Company, London, Ont. Capital stock, $100,000.

The Rivesville & Montana Telephone Company, Fairmont, W. Va.—to construct and operate a telephone line from Fairmont to Rivesville. Capital stock, $50,000. Incorporators: C. E. Gaskill, F. B. Clayton, J. P. Coogle and others.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Aug 1:						
Albany Ry. Co	100	2,000,000	$1,750,000	1½ % Q., Feb. '98.	144	145
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	68	70
Traction Co. (Saratoga)	100	50,000	50,000	....	..	..
Allentown, Pa.—Aug 1:						
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Aug. 1:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	35	..
Baltimore, Md.—Aug 1:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '97.	..	72½
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23⅛	23⅜
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—Aug 1:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	...	..
North Shore Traction Co....com.	100	4,000,000	4,000,000	....	10	12
North Shore Traction Co....pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	77	80
b West End Street Ry. Co....com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	85¾	86
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	105	106
Boston Elevated R. R.	100	10,000,000			66	..
Brooklyn N. Y.—Aug 1:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	205	210
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	58⅞	59
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR....guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	210⅛	212
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	...	195
Kings County Elevated	....	4,750,000	4,750,000	....	4	7
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	47	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	..	...
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Aug 1:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	55	60
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	80	81
Columbus O.—Aug 1:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	49	50
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Aug 1:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Aug 1:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	270	275
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12½	13
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	2½
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan., 98.	2 0	217
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	93½	91¼
jChicago West Div. Ry....guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry....guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Aug 1:						
Cincinnati Inc. Plane Ry....com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry....pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	114¼	114½
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Aug 1:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	87	89
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '97.	55	60
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	50	58
Detroit, Mich.—Aug 1:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	..	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Aug 1:						
City Railway Co....com.	100	1,500,000	1,470,600	1¼ % Q., Jan.1, '98.	100	102
City Railway Co....pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	150	155
People's Street Railway	....	1,100,000	....	....	100	..

*Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Aug 1:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	3 % S., Jan., '98.	140	..
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	..
Holyoke Mass.—Aug 1:						
Holyoke Street Ry. Co	100	400,000	400,000	4 % A., Jan., '98.	180	190
Hoboken, N. J.—Aug 1:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	..
Indianapolis, Ind—Aug 1:						
**Citizens' Passenger Ry	...	5,000,000	5,000,000		27	30
Lancaster, Pa.—Aug 1:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	..
Lancaster & Col. Electric Ry	....	....	87,500	....	..	..
West End Street Railway	....	....	....	....	..	..
Louisville, Ky.—Aug 1:						
Louisville Ry....com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	34	39
Louisville Ry....5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	96	100
Minneapolis, Minn.—Aug 1:						
Twin City Rapid Transit....com.	100	17,000,000	15,010,000	....	18	23
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,714,200	1¾ % Jan., '98.	..	100
Montreal, Canada.—Aug 1:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	264½	265½
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1¼ % S., J. & J.	96¾	97¼
Memphis, Tenn.—Aug 1:						
Memphis Street Railway Co	100	500,000	500,000	....	15	..
New Haven, Conn.—Aug 1:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—Aug 1:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	146	170
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co....com.	100	5,000,000	5,000,000	....	1	3
New Orleans Traction Co....pfd.	100	2,500,000	2,500,000	....	6	9
aCrescent City RR....guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	32
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	85	88
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	18	22
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	53	54½
New York—Aug 1:						
Central Crosstown RR	100	600,000	600,000	2½ % Q., July, '97.	240	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Jan., '98.	150	160
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98.	175	195
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Jan., 98.	153	153½
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	32	34
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	210	220
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98.	180	..
hEighth Avenue RR	100	1,000,000	1,000,000	....	320	350
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q., Feb., '98.	340	360
jNinth Avenue RR.........guar.	100	800,000	800,000	....	170	180
kSixth Avenue RR......guar	100	2,000,000	2,000,000	....	200	210
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q. Feb., '98.	330	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., Jan., '98.	177	180
Third Avenue RR	100	12,000,000	10,000,000	2 % Q., Feb., '98.	176	180
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000		58	62
*Union (Huckleberry) Ry	100	2,000,000	2,000,000		175	200
Newark N. J.—Aug 1:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000		48⅞	49
Newark Passenger Ry	100	6,000,000	6,000,000		..	..
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Aug 1:						
Allegheny Traction Co	50	500,000	500,000	....	44	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	..	[illegible]
Consolidated Traction Co....pfd.	50	15,000,000	15,000,000	3 %, May, '97.	49	[illegible]
pCentral Traction Co	50	1,500,000	900,000	....	..	...
qCitizens' Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	...
rDuquesne Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	..
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	‡2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	½ %, Jan., '96.	20½	25
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 97.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds..

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October,

s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Aug 1						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	158
Northampton, Mass—Aug 1						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	168	175
Omaha, Neb.—Aug 1:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson. N. J.—Aug 1.						
Paterson Ry. Co	100	1,250,000	1,250,000	....	85	86
Providence, R. I.—Aug 1:						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	60	64
Philadelphia.—Aug 1:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	43½	45
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98.	65⅝	66
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	65	66
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450	....	18¾	18⅞
bElectric Traction Co	50	....	8,297,920	....	71¼	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	390	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	256	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135½	..
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
¿Philadelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	89¼	89½
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry.....guar..	50	1,000,000	‖580,000	$6 share—July, '98.	142¼	..
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	175	180
jPhiladelphia & Gray's Fy. RR..	50	1,000,000	298,650	$3.50 share July '98	90¼	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	288	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
jj17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	275	...
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.—Aug 1:						
Rochester Railway Co	100	5,000,000	5,000,000	....	9	12
Reading, Pa.—Aug 1:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..
kCity Passenger Ry	50	350,000	350,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	64	..
St. Louis Mo.—Aug 1:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % July, '98.	125	127
National Railway Co	..	2,500,000	2,479,000	1½ %, July, '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '93.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry.........com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	110	112
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	54	56
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—July.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	107	108
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅝	53¾
Presidio & Ferries RR	100	1,000,000	550,000	....	...	8½
Scranton, Pa—Aug 1:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
m Scranton & Carbondale Trac. Co..	100	500,000	500,000	....	..	18
m Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Aug 1:						
Springfield Consolidated Ry	100	750,000	750,000	....	....	11
Springfield O—Aug 1:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—Aug 1:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—Aug 1:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	96¾	97¼
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	264¼	265½
Washington, D. C.—Aug 1:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	73⅛	75
Columbia Ry. Co	50	400,000	400,000	6 % A.	76½	78
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	121	123
Worcester, Mass.—Aug 1:						
*Worcester Traction Co.......com.	100	8,000,000	8,000,000	....	15	17
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	91½	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Aug 1:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 1:						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., July, '98.	276	278
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	69½	70
New England Telephone Co	..	10,894,600	10,894,600	$1.50 %, Feb. '98.	133½	134
New York.—Aug 1:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	94½	95½
*Central & South Am. Teleg. Co.	100	6,500,000	6,500,000	1½ % Q.	103½	104
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	160	180
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1½ % S.	40	..
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan.., '98.	69½	70
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	112	115
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	107	110
Mexican Telephone Co	100	2,000,000	......		.59½	.75
*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1½ % Q., Jan., '98.	150	151½
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	73	77
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	92¾	92⅞
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Aug 1:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '96.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	170	175
Chesapeake & Potomac Telep. Co.	100	......	......	....	51	..
Chicago Telephone Co	100	......	......	....	202	..
Central Dist Prtg & Telg.Co.(Pgh.)	100	750,000	750,000	....	..	..
Empire & Bay States Telegraph Co.					70	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	74	76½
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	110	115
Providence (R. I.) Teleph. Co	50	......	......	....	85	86½
Southern New Eng. Teleph. Co	100	8,000,000	......	....	119	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 1:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25				..	..
General Electric Co..........com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	89¾	89⅞
General Electric Co..........pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	94	95
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	25¾	26½
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., July, '98.	54½	55½
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Aug 1:						
Edison Elec. Ill'g Co., New York..	100	9,138,000	7,938,000		126	131
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	4,000,000	1½ % Oct., '97.	124½	125
Edison Ore Milling Co	100	......	......		11	14
Edison Electric Storage Co					21	23
General Electric Co..........com.	100	40,000,000	30,460,000	2 % Q., Aug, 1898.	89¾	89⅞
General Electric Co..........pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	94	96
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co....pfd	..	......	......	...	..	..
Pittsburg, Pa.—Aug 1:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	180	110
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Aug 1:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co...com.	100	8,500,000	......	......	87	87¼
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	42¼	42½
*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	......	50c. p. sh., Oct. '97.		
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.		
Northern Elec. Light & Power Co..	10	6,500,000	550,000	$32500 dis. Jan. 11 '97	13½	14
Southern Elec. Light & Power Co..	10	187,500	187,500	....	8	10
Miscellaneous.—Aug 1:						
Brush Electric Co	50	......		......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000		......	40	..
Missouri-Edison (St. Louis)....com.	..	......		......	15	18
Eddy Electric Mfg. Co	25	......		......	..	18
Hartford (Conn.) Elec. Light Co	100	850,000		......	115	125
Hartford (Conn.) Lt. & Power Co..	25	175,000			4	7
New Haven (Conn.) Elec. Lt. Co	100	100,000			156	166
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000		2 % Q., Oct., '96.	80	87
Rhode Island Elec. Protec. Co	100				110	120
Royal Elec. Co. (Montreal)	..	1,000,000		2½ Q.	*158	160
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	136½	136¾
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	....	......	....	100	110

*ex d.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Aug 1:						
American Electric Heating Co	50	10,000,000	....	....	.05	.07
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb. 1, '96	85	87
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—Aug 1:						
Consolidated Electric Storage Co	..	......	....	....	18	20
Edison European	..	......	....	....	1	3
Safety Car Heating & Lighting Co	100	......	....	....	..	98½
Worthington Pump Co.........com.	100	5,500,000	5,500,000	....	80	33
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	90	92
Philadelphia, Pa.—Aug 1:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	......	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	......	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	......	74½	..
Welsbach Commercial Co.....com.	100	8,500,000	......	......	18	20
Welsbach Commercial Co.....pfd.	100	500,000	......	2 % Q	74	75
Welsbach Light Co	5	525,100	......		58	54
Welsbach Light Co., Canada	5	500,000	......		1½	1¾
Pittsburg, Pa.—Aug 1:						
Carborundum Mfg. Co	100	200,000	200,000		..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	110	112
Miscellaneous.—Aug 1:						
*Barney & Smith Car Co........com.	100	......	1,000,000	....	..	15
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	..	65
Billings & Spencer Co	25	......	....	....	30	37
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	80	85
Johns-Pratt Co	100	......	....	....	..	97
*Pratt & Whitney Co...........com.	100	......	....	....	..	10
*Pratt & Whitney Co...........pfd	100	......	....	....	45	53
Stillwell-Bierce Co...........com.	..	......	....	....	96	98
Stillwell-Bierce Co...........pfd.	..	......	....	2 % Sept. 1, '97.	107	110
Shults Belting Co	100	500,000	....	....	60	90
St. Charles Car Co	....	....	....	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Aug 1, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	112½
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*118½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..................1st 5s	....	....	......	......	*105	105½

†Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Aug 1, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113½	114
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	113½	114
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103½	104
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116¼
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	102¼	102¾
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s.	96,000	117,000	1912	J. & J.	......	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	116	117
City & Suburban Ry......1st mtg. g. 5s.	8,000,000	8,000,000	1922	J. & D.	114	......
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	....
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	118	119⅛

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,879,000	8,702,000	1924	J. & D.	101½	105
West End Street Ry........Deben. g. 5s.	8,000,000	8,000,000	1902	M. & N.	104	105
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry...........1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¼	102¼
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	103⅛	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	8,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	54	54¾
North Chicago St. RR........1st mtg. 5s.	8,171,000	8,171,000	1906	J. & J.	104	105
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	104	104¼
West Chicago St. RR.........1st mtg. 5s.	4,100,000	8,969,000	1928	M. & N.	104½	....
West Chicago St. RR........Deben. 6s...	2,700,000	700,000	1911	J. & D.	99¼	99⅞
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	94
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Aug 1, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	8,000,000	2,500,000	1922	J. & J.	102	102½
*Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	107⅛	108
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108½
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‡So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

† Assumed by the Cincin. St. Ry. Co.
‡$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	102	102½
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	8,500,000	1,249,000	1918	M. & S.	103½	105
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
aEast Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102	105
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked a.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	8,835,000	1905	A. & O.	97⅛	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	....
The Detroit Ry................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 5s.	100,000	94,000	1909	M. & S.	102	......

*With interest. *Unlisted.

New Orleans La.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	101	....
Crescent City RR.............1st mtg. 6s.	......	50,000	1899	M. & N.	100¼	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1913	J. & J.	76	79
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	105	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100¼	101¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	110	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	101¼	....
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	104¼	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	85	87
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	8,000,000	1,966,000	1931	A. & O.	106	109
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	110	112
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	114	116
Broadway Surface............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	106⅛
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	115½
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	87
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	103	....
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	105⅛	108
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	103⅛	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	101	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	111⅛
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118⅛	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100	*108
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115	118
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	95
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	121	122
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	115	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108⅛	109⅛
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	115	117
South Ferry RR. Co..........1st mtg. 5s.	350,000	850,000	1919	......	107	......
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	121	122⅛
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	108	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	111	113
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1948	J. & J.	111	112⅛

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.......................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation - Aug 1, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.......................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	....	....	....
People's Pass. Ry.....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry.....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	102	108
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry..................1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co.................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry..........1st mtg. 7s.	....	....	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Aug 1, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	....	......
Central Traction Co..............1st mtg. 5s.	875,000	875,000	1930	J. & J	......	....
Citizens' Traction Co............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co...........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108¼	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	....	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	105⅛	....
Millvale, Etna & Sharpsburg...............5s.	750,000	750,000	1923	M. & N.	105	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	....	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	....	105
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co.......................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co.........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation—Aug 1, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR.........1st mtg. 5s.	250,000	250,000	1918	J. & J.	100⅛	101⅛
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	101½	102½
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 5s	1,000,000	1,000,000	1913	J. & J.	111	112⅛

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Aug 1, 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	$50,000	$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry...........1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.......................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	105½	107½
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	106	107
‡Mound City RR. Co.............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	108
People's RR. Co....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co.....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co...............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry..............Income 5s.	800,000	800,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110½	111½
‡Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation— July, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114¾	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	113½	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	92½	97½
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	126	....
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co..............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	124½	......
†Park & Cliff House RR........1st mtg. 6s.	350,000	350,000	1912	J. & J.	109	......
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	88½	110
†Powell St. Ry.......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118½	120
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109¾	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Aug 1, 1898.						
Belt Ry. Co.......................Cons mtg 5s.	500,000	450,000	1920	J. & J.	33	....
Columbia Ry..............................1s mtg. 6s.	500,000	500,000	1914	A. & O.	118	122
Eckington & Soldiers' Home 1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	118	119½
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Aug 1, 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	104	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	111¼	112
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	8,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	8,000,000	2,366,000	1932	M. & N.	108½	109¾
¶Columbus (O.) St. Ry......1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	100	104
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	105¼	105½
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	106
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	79
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	114	114½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	90	93
††No. Hudson Co. Ry. (N. J.).Cons. mtg. 5s	8,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N. J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry...........1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	96	....
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Aug 1, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	104	....
Pittsburg, Pa.						
Date of Quotation—Aug 1, 1898						
Allegheny County Light Co..............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light...........4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Aug 1, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	110	....
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117½	......
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Aug 1, 1898.						
American Bell Telephone...................7s.			1898	F. & A.	100	....
Northwestern Telegraph Co...............7s.	....	......	......	......	....	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Aug 1, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co....................	....	....	......	......	......	25
Barney & Smith Car Co.....................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co........................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co..............................	75,000	......	......	......	....	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11@11⅛c.; Lake, 11⅛c.; casting, 11@11⅛c.

The earnings of the Halifax (N. S.) Electric Tramway amount to about $14,000 a month. The capital stock of the company is $800,000.

The Chicago Edison Company has sold $350,000 new 5 per cent. gold bonds on a 4½ per cent. basis, making $3,325,000 of this issue now floating.

The Erie Telephone & Telegraph Company has declared its regular dividend of 1 per cent., payable August 15. Books close August 6 and reopen August 15.

The trustees of the Street Railway & Illuminating Properties declared a dividend of $4 a share on the common stock, payable July 30.

The New England Telephone & Telegraph Company has declared a regular quarterly dividend of $1.50, payable August 15. Books close August 1 to August 13 inclusive.

On August 11 stockholders of the Commercial Cable Company will hold a special meeting for the purpose of voting on an increase in the capital stock of $400,000.

The Albany (N. Y.) Construction Company, the corporation which is to build the Albany, Helderberg & Schoharie Railroad, has filed in the county clerk's office at Albany a certificate of the payment of its capital stock, amounting to $5,000.

The Western Union Telegraph Company's central cable office, New York, reports that hereafter (change began August 1) the rate to Bermuda will be 42 cents per word, instead of 81 cents, the former rate.

On the 26th ult. the committee on railroads of the St. Louis city council reported with numerous amendments the bill for a consolidation of the Lindell Railway lines. The bill as amended gives the Lindell Company the right to build eleven miles of new track.

The Detroit, Plymouth & Northville Electric Railway Company filed a mortgage at Detroit, Mich., on the 26th ult. for $150,000, running to the Union Trust Company. The mortgage is on the franchises and real estate of the company, and is to secure an issue of $125,000 worth of bonds.

It is reported on what is stated to be good authority that leading interests in the Pennsylvania Railroad Company have become large stockholders in trolley companies in cities and towns through which the Pennsylvania runs. This is thought to be preliminary to a possible control of the trolley lines for the sake of the steam roads.

The United Traction Company of Pittsburg, Pa., makes the following statement for the year ending June 30: Gross earnings, $1,475,764; expenses, $685,819; net earnings, $789,944; fixed charges, $590,445; balance, $199,499. The preferred dividend calls for $150,000, so that $49,000 is left for the common stock, of which there is $17,000,000.

A certificate of an increase of the capital stock of the Nassau Railroad Company of Brooklyn from $6,000,000 to $15,000,000 was filed at Albany on the 28th ult. with the Secretary of State, the increase having previously been approved by the State Railroad Commission. The increase is to be expended in pay for road extensions and improvements already made and to be made.

The Anglo-American Telegraph Company announces an interim dividend for the quarter ended June 30 of 15s. per cent. on the ordinary stock and £1 10s. on the preferred stock, after placing £6,000 to renewal fund. A year ago, after the same sum had been transferred to renewal fund, the dividends were respectively 14s. and £1 8s.; £17,580 is carried forward, compared with £8,500.

The Philadelphia "Times" of July 28 says: "Some of the interests in the American Railway Light Company are understood to consider it the best course for the company to go into the hands of a receiver and reorganize. The opinion is expressed that as there is no money in the treasury and $2,500,000 stock outstanding, all of the treasury stock having been sold, the company should be rehabilitated, as it is claimed the patents and system are valuable."

The Boston "Commercial Bulletin" of Saturday last says: "Directors of the Boston Elevated Railroad Company declared a dividend of 2½ per cent. on Thursday, payable August 15 to stock of record August 1. This is on the $50 per share paid in. Insiders prefer to have it understood that the foregoing is not a dividend, but interest on the amount paid in for six and one-half to seven months, ending August 1. The money represents income from various sources."

When questioned on the subject of the consolidation of the Chicago street railways, which it was reported Mr. Leiter had brought about, President Charles T. Yerkes of the North and West Chicago street railroad companies, said: "The article in a morning paper stating that I have a scheme to consolidate all the street railroads of Chicago, and that I went to New York to meet Mr. Leiter and talk the matter over with him, was absolutely without foundation. I have had no meeting or conversation with Mr. Leiter while in New York, or ever, on the subject of consolidating the street railways."

The Porto Rico Commercial Company filed articles of incorporation at Trenton, N. J., on the 28th ult. The company is authorized to do a general shipping and commission business, build docks, piers, wharves, own and use steamers and sailing vessels for carrying freight or mail, build and operate telephone or telegraph lines, own and operate electric railways, and construct and operate grain and other elevators, flour mills and sugar refineries. The capital stock is $500,000, divided into 5,000 shares, of which William D. Martin, of New York, holds 1; Felix B. Ruthenburg, of New York, 4; Isaac W. Taussig, of New York, 4, and Allen W. McDermott, of Jersey City, 1.

According to the so-called Ackerman report on Chicago street railways, street railway traffic in that city has increased 105 per cent. in ten years. This increase was greatest on the south side, where it reached 118 per cent. The west side increase was 100 per cent. and the north side 87 per cent. A good reduction in operating expenses is shown in the ten years. In 1888 the Chicago City Railway's operating expenses were 73 per cent. of gross earnings, last year 60.40 per cent. West Chicago's in 1888 were 65 per cent., last year 49.50 per cent. North Chicago's in 1888 60 per cent., last year 46.83 per cent. In 1888 a fair proportion of the city's mileage was covered with horse power which now is operated by cable and electricity.

"Bradstreet's" says: "Perhaps the most convincing proof of the truth of the saying that 'trade follows the flag' is found in the quick recognition given by American business men to the possibilities lying practically dormant in the territories recently opened to American enterprise by American sailors and soldiers. However disinterested our motives for interference in Spain's dependencies may have been, there is no escaping from the fact that with the triumph of American arms has come a healthy inclination on the part of American business interests to explore and exploit the resources of the sections of country now under American rule."

The Boston "News Bureau" says: "A. B. Ryan, president, W. R. Usher, treasurer, and A. P. Sawyer, director, of the Electrolytic Marine Salts Company, issue a statement to stockholders, in which they say that the story in the New York 'Sunday Herald' is conclusive evidence of a conspiracy on the part of Messrs. Jernegan and Fisher, that they have undoubtedly left the country and disabled the electrical apparatus at North Lubec. Active measures have been taken to apprehend the criminals and protect the stockholders, and a call for a stockholders' meeting will soon be issued."

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CONTENTS.

EDITORIAL NOTES.

Education as a Promoter of Commercial Interests.

The United States during the last few years has made marked progress in the matter of finding new foreign markets for its products, as may readily be gathered from the fact that in 1897 our exports amounted to $1,050,993,556, as against $1,231,329,950 for the fiscal year ending in 1898; an increase of $180,336,394 in spite of the more or less unsettled condition of the country. The manufacturers of this country, and especially those in the electrical and kindred lines, are apt to forget however that the desirable fields for American products and manufactures, such as for instance Japan, China and South America, present equally attractive markets for those of other countries. This contest promises to be one of long duration, governed solely by the survival of the fittest. Just to whom the honor of supplying the numerous markets that are slowly being created will belong is difficult to predict, but it is inevitable that it will be that country whose men are best fitted to cope with existing conditions in other countries, who speak the language of those countries, and who are in every way up to date. That these conditions are recognized in other countries is a well-established fact, and as an evidence of this we find Germany, our most formidable rival in the manufacture of electrical apparatus, starting commercial schools for the purpose of equipping her young men thoroughly for these ends.

Austria-Hungary will on the first of next October open an institution in Vienna to be known as an "Export Academy." This is the outcome of a suggestion offered last year by Emperor Francis Joseph, to the effect that every effort should be made to encourage the export of home industries, and that to attain that end it would be necessary to give the coming members of the industrial communities a special education in commercial matters in order that they should be fitted in every respect to become the developers of home trade with foreign countries, and that they might be able to fill the position of Consul in those countries with a reasonable degree of intelligence and consequent success.

The institution in Austria has received the sanction and financial support of the home Government. This move is a practical one. Our own exports show an increase for the past fiscal year that has been phenomenal, but the men who are to-day at the head of our large manufacturing concerns, and who have grown up with the increase of trade and are thus in a measure fitted to cope with the situation without a special training, cannot last forever, and then will come the need of young men acquainted with foreign languages, customs laws and transportation facilities—in short, men of sufficient education to leave them masters of the situation in every instance that may arise. Then again, our consular service almost invariably undergoes changes with every passing Administration, and in many instances men are chosen for their political rather than their commercial ability; the result is that oftentimes men are assigned to positions the requirements of which they are wholly unacquainted with and to whom in many cases the language of the country is unknown. Is it reasonable to suppose that such a man could exert as much influence as could a man thoroughly equipped beforehand for the work? No matter how willing or how patriotic he may be, he is handicapped, and this too at a time when other countries are bending every effort to the advancement of their interests in all the foreign markets of the world. To keep pace with other exporting nations it behooves us to push steadily on, organize, equip and provide export educational institutions, and in this way, together with a careful study of the tastes of all prospective customers and a ready compliance with their wishes, our foreign trade must necessarily expand far in advance of our present expectations or the conceptions of even the most sanguine.

* * *

Device for Preventing Collisions at Sea.

Elsewhere in this issue will be found an illustrated article which describes in detail an ingenious device invented by Mr. Hermann Herberts for the purpose of warning a vessel at sea during a fog of the approach of another vessel, or of the vicinity of an iceberg, and thus reduce to a minimum the chance of another such accident occurring as was recently met with by the ill-fated La Bourgogne. Various types of auricular signals have been in use for some time in conjunction with the eophone, topophone and other similar receiving devices with varying success. Mr. Herbert's device however is based on the principle that an object emits heat radiations when its temperature is either higher or lower than the surrounding atmosphere. By a novel arrangement of a thermopile to receive such radiations in conjunction with a galvanometer the inventor feels confident he has devised an arrangement that will give warning in time of fog of the approach of a vessel or the proximity of an iceberg or other dangerous object. Two separate sets of apparatus would be required on a vessel, one on each side, and would have to be carefully shielded from outside influences by means of alum or other heat-absorbing solution. The device is very delicate and would not only give warning of the approach of a vessel or

iceberg, but would also indicate its approximate direction. It is unquestionably true that were an apparatus such as the above to achieve what is claimed for it when given a practical trial, it would materially lessen the danger of ocean travel in time of fog and would act as a boon to humanity by preventing such frightful catastrophes as that of La Bourgogne.

* * *

The "Electrical World" and Electrical Fakes. In reference to the Electrolytic Marine Salts Company's bubble, which has just broken so disastrously for many New Englanders of moderate means, we are pleased to see that some of our electrical contemporaries have taken the matter up and aptly point to the evil effect such swindles have upon the electrical industry in general. For instance, the *Electrical World* in an editorial of August 6 on the above subject says: "The majority of these fraudulent schemes are self-evident, such as, for example, the power-multiplying device recently exploited and actually exhibited. Against such it seems that not only the technical press, but those engaged in any branch of the industry, should wage unceasing war. *They should be exposed before the harm is done, not afterward.* There is no public service that can be rendered by the members of the electrical fraternity greater than the stamping out of the charlatans who bring it into disrepute and the swindlers who use the legitimate triumphs of science to mislead and rob the public. The public cannot protect itself from these thieves, because it does not know how; those of us who do know how can protect not only the public, but ourselves as well, by combining for the exposure and prosecution of all sorts of electrical fakirs."

The italics are ours.

We heartily endorse the sentiments expressed by our contemporary, the *Electrical World*, and have all along felt it our duty to expose electrical frauds *before the harm is done, not afterwards.* But why does the *Electrical World* not live up to its sentiments expressed so grandly? Why wait, as in this case, until the horse is missing and then hurry to slam the barn door with a bang? When the Electrolytic Marine Salts Company was first talked of, ELECTRICITY pointed out, vide its issue of December 1, 1897, that the scheme was a "fake," as what gold there was in solution in the sea could not be procured by any such easy process as was suggested. In our issue of June 8 we further made the statement that the sea water gold scheme should be classed in the same category with the Electropoise, electric combs and electric shoes. Were other electric papers, including the *Electrical World*, as bold and prompt in coming forward at the outset, before much harm is done, and declaring electrical swindling schemes swindles as is ELECTRICITY, fakirs who contemplate using the word "electric" as a bait would think twice before embarking in their projects. This is but one of the many occasions in which ELECTRICITY has proven that it alone has the right to the title of only independent paper in the trade.

* * *

Determining Electrically the Speed of Projectiles. It may interest our readers in these war days to know that in determining the speed of a modern projectile electricity plays an important part. The method consists in an ingenious application of the chronograph, which, as is well known, has been used extensively in astronomical work where extreme accuracy is needed and where very small fractions of a second have to be recorded.

The forward velocity of either a bullet or shell after being discharged from a gun is now determined by means of two screens on which a length of copper wire is vertically strung in such a manner as to form a continuous conductor. These two screens are placed in line some fifty yards apart. The wire on the first screen is connected with what is known as a chronometer battery, in circuit with an electro-magnet which holds up one of the chronometer rods, and with a disjunctor, which is an instrument used to break both screen circuits at the same instant. The second screen is then placed in a battery circuit with the disjunotor and the electro-magnet controlling the second chronograph rod.

So long as these two circuits remain intact and an electric current passes through them, the chronograph rods will be held up and away from the chronograph sheet owing to the force exerted by the electro-magnets.

As previously stated, the disjunctor is an instrument which is used to break both circuits at the same time, which is done before an experiment begins with a view to obtaining a point of origin to measure from later. When the circuits are again closed and the chronograph rods consequently lifted, were a bullet to be fired through the screens it would first rupture a wire in the first screen, which would open the circuit and cause the first chronograph rod to drop and register a small wedge-shaped mark on the chronograph sheet. In passing through the second screen the same thing would occur, the second chronograph rod lever being the one to fall this time and register a mark. It is now only necessary to determine the time at which both breaks in the circuits occurred. This is accomplished by accurately measuring the distance between the first dent, the origin and the second dent. By determining by the law of gravity how long it would take a body to fall the distance measured will give the time it took the projectile to travel over the distance separating the two screens. Knowing the length of time it takes a projectile to travel over a given distance, the speed of that projectile per second may readily be computed. An instrument known as the synoronoscope, intended for the measurement of the velocity of projectiles and invented by Lieut. George O. Squier, is on exhibition at the Trans-Mississippi and International Exposition at Omaha.

Under the Searchlight.

Notes and Comments on Various Topics

THE temperature must be exceedingly high in Schenectady to-day!

* * *

HIRAM S. MAXIM, the inventor and manufacturer of rapid-fire guns and many other devices of practical utility, arrived from England on the Etruria on Saturday. Mr. Maxim, besides being an inventor, is something of a wag, and when a press representative tackled him for a talk on his arrival he respectfully declined, saying: "I am the Maxim who works with his hands, but there is another Maxim who talks with his mouth." He however consented to say a few words, closing with the remark: "The last thing my English friends said to me when they knew I was coming to America was: 'Tell 'em not to give up the Philippines.'" Mr. Maxim will stay in New York and vicinity for a few days, and will then go on a visit to his mother who resides in Wayne, Me., and will afterwards spend some time with his wife's relatives in Boston.

* * *

ONE of the New York dailies in describing the recent electrocution which took place at Sing Sing said: "Every man was immovable except the electrician, who threw his lever over again, gave Thorn another shock, which a little later was again repeated." Now we strenuously object to the word "electrician" being applied to an executioner. If a descriptive word is necessary, let it be electrocutioner, but to call a man who should be classed in the same category with an ordinary hangman or with Monsieur de Paris an electrician is an insult to every worker in the electrical field.

* * *

OUR contemporary, the *Electrical Engineer* of London, with its usual conservatism and perspicuity, expresses its opinion of the Electrolytic Marine Salts Company's scheme as follows:

A "Yankee" writing to the *Financial Times* claims that the recovery of gold and silver from the sea can be effected commercially. He says that the Electrolytic Marine Salts Company, which has its plant on the coast of Maine, started operations on February 4 with five machines, which were increased to 114 on March 15, and on May 8 a further increase to 239 was made. Some five million tons of water were manipulated during the period named, and the product for the four months is said to be 940 oz. of gold and 1,814 oz. of silver (worth about £5,000), at a cost of less than £1,000. The second plant of 5,000 machines is now being constructed, and the "Yankee" says "the mine being on the mother lode, there is nó danger of losing the vein." A 3 per cent. dividend has been declared by the company, and yet we prefer to wait another year before believing that the "mother lode" has been commercially attacked.

* * *

THE men in the blockading fleet off Havana are beguiling the weary days by shark fishing on somewhat novel lines. The men fasten a small dynamite cartridge to the end of a wire attached to an electric machine. A lump of pork is attached to the cartridge and thrown overboard, and as soon as the creature swallows the bait the current is turned on, the dynamite explodes, and the shark is blown to pieces.

* * *

THE Philadelphia *Times* says: "It is found that the X-ray shines through a fox terrier as if he were a Chinese paper lantern. The experiment has just been tried on an animal of this species which had swallowed a diamond ring, the trinket appearing twinkling in his midst—visible as a fly in amber or a gold fish in a glass globe. All the dog family will do wisely to lay the lesson to heart and look sharp what they swallow."

* * *

A BOSTON financial paper states that the General Electric Company has secured control of the Schenectady Illuminating Company and the Schenectady Street Railway Company for $750,000. This sum would have paid one half the accumulated dividends on the preferred stock But it is not the policy of this company to pay its stockholders, but rather to capitalize its debts.

* * *

THE Norristown *Herald* is responsible for the following: "Some one says that a man who is struck by lightning cannot swim. He does not want to swim. What he needs in nine cases out of ten after being struck by lightning is a cheap and unostentatious funeral."

Death of Adolph Sutro.

The death of Adolph Sutro at San Francisco on the 8th inst. removes from the busy world a man whose name is widely known not only in this country but abroad, owing to its connection with the great tunnel for drainage purposes which Mr. Sutro constructed at the Comstock lode in Nevada. He was also the inventor of an improved process for the reduction of silver ore. Through his connection with the mining industry he was enabled to accumulate a large fortune, which allowed him to carry out several important enterprises in San Francisco, one of which was the well-known street railway bearing his name. He was one of the early settlers in San Francisco, landing there on November 21, 1850. Although an exceedingly wealthy man he was a strong anti-monopolist and devoted to the interests of the masses. This trait was responsible for his being elected Mayor of San Francisco. He died leaving an estate estimated to be worth between $20,000,000 and $30,000,000. For several years before his death his mind was impaired.

IS THERE ANY EXCUSE FOR COLLISIONS AT SEA?

Means for Detecting the Presence of a Vessel or an Iceberg—How Their Movements May be Followed.

BY HERMANN HERBERTS,
Newark, N. J.

The recent Bourgogne disaster, connected with such heavy loss of life, such fearful dramatic scenes, where brutal selfishness was predominating to such an extent that fiendishly cruel means were resorted to in butchering and annihilating the weaker element, has caused a deep and everlasting impression upon its survivors, upon everybody endowed with a fellow-feeling.

The average person lacks coolness of mind in such critical moments, and in losing all self-control shakes that of those so far unaffected. It seems to me that travelers should be made familiar with the safety appliances on board, and I venture to express the hope that the Bourgogne disaster will not only cause the different navigation companies to give to their patrons practical lessons in using and applying such expedients, but also such further information as may be of benefit to them in case of accidents.

As to the matter of life boats, improvements seem highly desirable and particularly to quick and efficient means for launching them. Many lives were lost just on account of this deficiency. It should be made compulsory for each vessel to have a total carrying capacity of their life boats exceeding by 10 or 20 per cent. the maximum number of passengers carried.

This Bourgogne disaster has stimulated within me the desire of finding some suitable means whereby collisions at sea may be avoided.

Before entering into a discussion of these it may be in order to mention a few methods of signaling now in use. Among the auricular signals we have, with an approximate hearing distance in miles, the following:

Air sirene	10–12 miles.
Steam sirene	8–10 "
Trumpet	6 "
Bell	1 "

This hearing distance is however not constant, and depends upon many conditions which are referred to below.

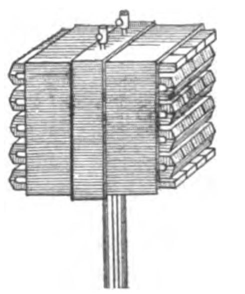
For receiving the sounds the eophone, topophone or similar instruments have been employed with more or less success; the object of these instruments being to furnish a means whereby to determine the direction from which the sound proceeds. The eophone consists of two bell-shaped receivers separated by a central diaphragm, the further end tapering down and being connected with ear tubes. The whole is mounted in a suitable manner whereby it is possible to point the open ends in any direction desired. If the receivers point in the direction of the sound, then each ear will perceive it with the same intensity.

Under existing conditions it is necessary that both vessels be active, not only in giving signals, but also in "attempting" to intercept them. The safety of a vessel consequently not only rests with its own crew, but largely depends upon the watchfulness of the other vessels. A good deal of blind confidence is therefore placed in any stranger who may come along. It is not this alone which makes navigation dangerous during a heavy fog, it is made much more so on account of coinciding circumstances which as yet are not fully understood. At times it is impossible to perceive the phonorous signals when the steamer is nearby, while the signal was plainly heard from some greater distance. As to the cause of this surprising interruption (seeming) in the propagation of sounds, investigations have been carried on by the United States, Germany and France. The investigations made by Major Livermore, in compliance with the United States Admiralty, have thrown some light upon this subject. It has been deduced that obstructions to sound, or an irregular formation of the coast, not only materially affect the strength, but also the propagation of the same. Obstructions behind the source of sound will reinforce them in a similar manner as a screen will reflect the light. Rain and snow will have a great influence upon the direction of the sound.

It has been observed that under certain conditions a sound could not be heard near the surface of the water while it was heard plainly some distance above it. In one experiment Major Livermore's vessel had been placed in such a position that the blowing of whistles, even the shooting of a cannon, was heard at one end of the vessel most distinctly while it was impossible to perceive any sound at the other end, although the steam or smoke could be seen to arise. It seems therefore that under certain conditions sound waves may be projected upward to descend again at some distance and finally take up their original direction. No doubt this remarkable interruption has caused many accidents.

At the first thought it would seem that wireless telegraphy would meet all requirements. Reflecting upon this will soon convince us that each and every vessel afloat would have to be equipped with a complete set of apparatus. Even if their use were made compulsory, the safety of a vessel would be largely dependent upon the other vessels in a similar manner as outlined above.

Although the introduction of this kind of apparatus would make navigation safer, the location and movements of other vessels could nevertheless not



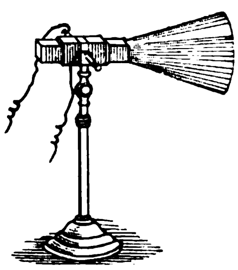


FIG. 1. FIG. 2.

be determined. Besides the vessels there are icebergs and floating wrecks.

Taking all in all it is desirable to find a means which will indicate the nearness or approach of any object.

It is well known that any object, when its temperature is higher or lower than that of the atmosphere surrounding the same, will either send forth heat radiations, or else, in the other case, absorb heat from its surrounding medium. In the winter we clothe ourselves to keep warm; in other words, we surround ourselves with a poor heat conductor so as to diminish the heat radiations from our body to the atmosphere.

If we can construct an apparatus which is acted upon by such heat radiation, and if the apparatus be of such sensitiveness that it will intercept and indicate them, even if they be exceedingly weak, then we have a means which may be advantageously employed in navigation. As soon as we can intercept the radiations sent forth from a vessel we need not depend upon our ear or eye to locate the same.

A modification of the thermopile or the radiophone may be employed in connection with this problem.

A few remarks pertaining to these may prove of interest. Seebeck, in 1822, discovered that an electric current is set up in a closed circuit made up of different metals as long as the junctions would be maintained at different temperatures. The best effects have been subsequently obtained by the use of antimony and bismuth.

Fig. I shows the assembly of suitable metal strips, surrounded by an insulating casing, forming the thermopile. The free ends of the metal strips are connected to binding posts.

Fig. II shows such a thermopile rigidly supported and provided with a conical attachment, which is blackened on its inner surface. It serves the purpose of concentrating the radiations upon the exposed face of contacts, in that way augmenting the effects.

Fig. III shows part of an apparatus as proposed

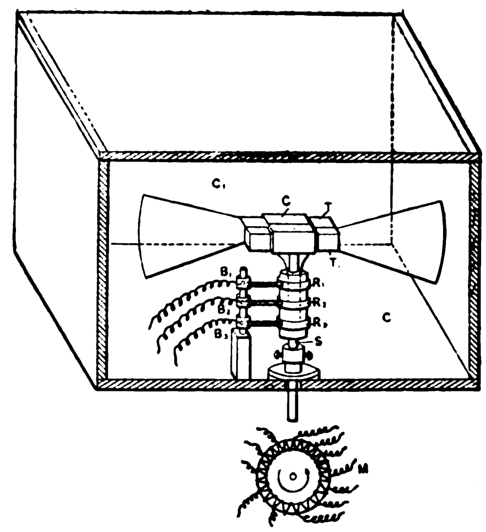


FIG. 3.

by me to the end of detecting the approach or nearness of a vessel, iceberg or obstruction. The two thermopiles T and T_1 are surrounded by an insulating casing C, and are attached to a shaft S, which may be revolved slowly. The insulated rings R_1, R_2, R_3 serve to establish a permanent connection of the thermopiles with the brushes B_1, B_2, B_3 from which wires may be led to the pilot house to the observation or indicating apparatus. The thermopiles are enclosed in a suitable compartment such as to exclude all air currents and to afford protection from the radiations of the sun and the vessel itself.

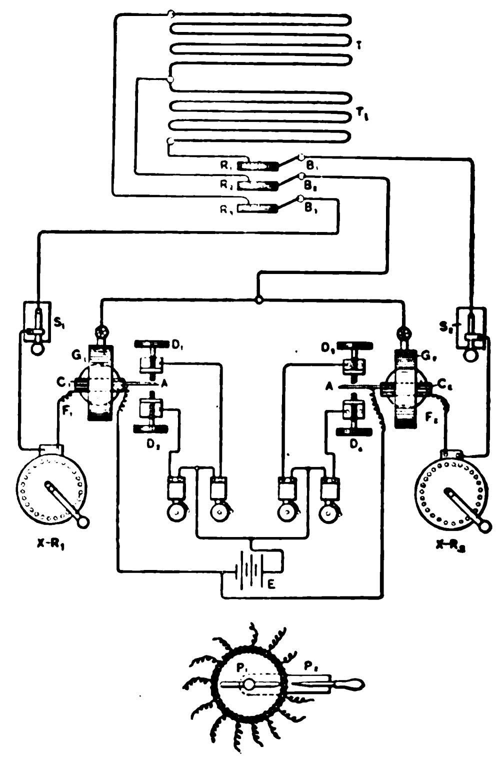


FIG. 4.

For this reason the whole is mounted on the outer side of the vessel. It may therefore be necessary to have one set of apparatus at each side of the vessel to afford a proper protection. A flat ▬ shaped, double-walled casing (not shown) surrounds the compartment C_1; the outer chamber of the former is filled with alum or other heat-absorbing solution for the

purpose of intercepting radiations due to the rays of the sun, either striking directly or being reflected from the water, and also for intercepting those which are emitted from the vessel itself. The inner chamber may be attached to a continuous water supply so as to remove all heat which the alum cell may have absorbed and also to maintain the chamber C_1 at a constant temperature—i. e., the temperature within the chamber should be constantly corresponding to that of the surrounding atmosphere, allowing for radiations just referred to.

Fig. IV shows a diagram of connections. A junction of two of the free ends of the thermopiles T and T_1 is led to the middle ring and thence over the brushes to the two galvanometers, G_1, G_2, here shown of the d'Arsonval type. The other terminals of the galvanometer coil, C_1, C_2, connect through adjustable resistances, XR_1, XR_2, and switches S_1, S_2 to their respective outside rings R_1 and R_2. For observations a galvanometer scale may be employed, or perhaps an automatic indicating apparatus as shown in Fig. IV. A light aluminum arm, A, fastened to the movable galvanometer coil, swings between two adjustable contacts, D_1, D_2, or D_3 and D_4. A local circuit, including batteries E and bells is completed should this arm be turned through a small angle. For indicating the exact position of the thermopile a large number of contrivances may be constructed. In these it should be aimed at to have a position indicator, P, operated by the same current which revolves the thermopiles.

Suppose now that in foggy weather when we cannot see, when we are in fear of being deceived by the sound, we start this apparatus and make ourselves independent of the watchfulness of other vessels. A vessel approaches—we are not aware of it—the radiations given out by the same are too weak to affect the apparatus—we come nearer each other—a stronger current is set up in one of the thermopiles at the moment it points in the direction whence the radiations proceed. Instantaneously the galvanometer coil is slightly turned, the aluminum arm makes contact and causes one of the bells to give a short ring. This happens once at every half revolution, as then the second thermopile becomes active. As the distance between the vessels diminishes, the effect will naturally increase and a contact is made covering a longer period of time. Watching the position of the slowly moving position indicator P at the moment the bell rings, and simultaneously cutting out one of the thermopiles by switch S_1 or S_2, will immediately give us an approximate knowledge of the direction from which the vessel is approaching us. To obtain a more accurate knowledge the adjustable resistance may now be manipulated. It being in circuit with the galvanometer, the current from the thermopile will of course be cut down. Under normal conditions, i. e., with the resistance cut out, the bell will operate for a certain length of time, depending upon the amount of radiations sent forth from the nearing vessel as well as the time of exposure to their influence; this again depends upon the speed of the revolving thermopiles. The purpose of the resistance then is to cut down the action of the thermopile to such extent that the aluminum arm makes contact only at the instant the maximum current is being produced. As this can occur only when the thermopile points directly towards the strange vessel, its position is immediately ascertained by simply moving the contact lever until the bell gives the shortest obtainable ring.

For all ordinary purposes the observation of the slowly moving position indicator arm P will therefore be sufficient. A small adjustable pointer, P_2, which may be swung around the outside casing of the position indicator, may serve to fix this position.

By the increased or diminished action of the thermopiles we know whether a vessel approaches or whether it recedes—by watching the position indicator we know whether the vessel is moving toward the right or toward the left. These means therefore enable us not only to ascertain the presence of a vessel, but also to follow its movements, and all this is accomplished by simply adjusting the rheostat, listening to the bell and watching the position indicator.

Safely passing the vessel, we now come near an iceberg. The effect is similar to that described, the current produced is however now flowing in the opposite direction, causing the coil to turn the opposite way and also a different bell to give its warning signal. It is possible therefore to tell the nature of the obstruction, whether it be a vessel or an iceberg. In the case of a floating wreck more difficulty is to be expected, as its temperature will not differ very much from that of the surrounding atmosphere. It may however be that if its entire exposed surface is in moist condition a sufficient fall of temperature is produced to affect the apparatus, and to do likewise on account of radiations given out due to exposure to the rays of the sun. For the same reasons it may also be possible to tell when nearing a coast.

The double thermopile is proposed for the purpose of increasing the action of the apparatus, as then it is possible to revolve the same at a slower speed, in that way giving a longer exposure to the radiations. At the same time the vessel is better protected. A combination of four of these would undoubtedly improve the effects considerably, as the speed may then be cut down still lower. A plurality of thermopiles suitably arranged would not require to be revolved.

The indicating apparatus, i.e., the galvanometer, should preferably be mounted so as to be free from vibration and in a similar manner to that employed with the compass, to make it independent of the ship's motions.

Now a few remarks touching upon the radiophone.

Berzelius in 1817 discovered selenium; Knox in 1837 found that it was an electrical conductor; May discovered that its conductivity is much influenced by light. In their experiments most physicists used the galvanometer, while Bell used the telephone. Bell and Taintor subsequently constructed the photophone, its receiver consisting of metal disks insulated from each other and covered with selenium. A ray of light—reflected from a mirror diaphragm against which is spoken—after passing through suitable concentrating lenses is reflected to a distant parabolic concave mirror and thence upon a selenium cell, which is in circuit with a telephone receiver and battery. Sound was in this manner transmitted over a beam of light. Later experiments showed that sound can be transmitted more efficiently by non-luminous heat rays. Mercadier then constructed the radiophone. In this instrument soot or lampblack is made use of, forming a bridge between the two electrodes which are in circuit with battery and telephone. For some experiments Graham Bell used a bottle or test tube, covered or filled with soot. Throwing the focused light on these would produce a sound if the rays be of an intermittent nature.

It is a fact, then, that heat rays will affect the conductivity of such radiophonic apparatus. Whether their application to the above end could be accomplished seems at this moment difficult to answer. If their sensitiveness can be brought up to that of the thermopile, and if no serious mechanical difficulties be met with in maintaining the soot in the proper place, then it would become a simple matter to apply such radiophonic apparatus for the purpose stated.

My first conception of applying these means dates back to July 7, 1898. I will not commit myself in stating that such methods as outlined above are absolutely feasible under all conditions, nevertheless they appear worthy of a careful perusal, study and experiment. Certainly a large number of factors must be dealt with in any attempt to solve this problem, so fascinating, interesting, and, what is more, of such vital importance.

The effects of winds, whether warm or cold, moist or dry, blowing toward or away from us and at different intensities; the effects of the Gulf Stream, the absorption of radiations due to the above, rain, snow or fog—all these may require investigation.

On account of the extreme sensitiveness of the thermopile and the galvanometer, I am led to believe that the attainment of the end in view is a possibility.

The need certainly does exist, nor will anyone disprove this statement.

Having means at hand by the employment of which collisions may be avoided, life and property be saved—perhaps your own, dear reader—why then, I ask, "is there any excuse for collisions at sea?"

Seeing all the possibilities, I most heartily advance these rather incomplete ideas and hope that the press here as well as abroad will contribute its share in discussing this subject. I also express the hope that all those interested will not withhold their opinion, and further, that influential parties will lend their aid to bring about a solution of this problem.

POWER DISTRIBUTION IN FACTORIES.*

Although considerable progress has already been made in the introduction of electrical distribution of power in factories, the field is such a large one that what has already been done is really but a drop in the ocean to what still remains. One of the greatest difficulties in the way of the general introduction of electrical power distribution is the want of actual figures, showing the saving effected in factories in which electrical methods have been adopted, as naturally the power user wants to see well authenticated figures and not merely probable estimates of the return he will get for the capital to be expended on an electrical plant. This difficulty is in great measure due to the impossibility of obtaining from the user of power an accurate statement of the average brake horse-power actually supplied to the driving shafts of the machines, or of the pounds of fuel used per brake horse-power-hour. One can learn that there are a certain number of engines in use, each rated at so many horse-power, but in many cases no information can be obtained as to the number of horse-power hours indicated per month or year, nor as to the percentages of the power which are actually applied to the shafts of the machines, or are wasted in engine friction or transmission. On the other hand, although the total bill for fuel and wages of stokers and engine tenders may be given, a considerable portion of this is chargeable in many factories to heating or purposes other than the production of power.

In a paper read before the Institution of Engineers and Shipbuilders in Scotland, Mr. H. A Mavor has given in tabulated form the replies received from a number of manufacturers to inquiries addressed to them by him; and these tables, though interesting as showing the cost per indicated horse-power per hour for fuel, stores and wages, illustrate very well the difficulties named above; as in the majority of cases the information is incomplete owing to no figures being given for the percentage loss in transmission, or to the fact that the proportion of the cost of steam raising which is chargeable to power cannot be determined. The replies received have been divided by Mr. Mavor into two groups, one for weaving, spinning, thread, tweed, corn and flour mills and engineering works, in which power is derived from one or two main engines, and the other for paper mills, chemical, sugar refining and engineering works, in which power is derived from a number of small engines erected in various parts of

*From the *Electrical Review*, London.

the works. From a third table, summarizing the results of the inquiry, we find that for the first group the average coal consumption per indicated horse-power-hour is 3.1 lbs., the average price paid for coal is 5s. 5d. per ton, and the average cost per indicated horse-power-hour for fuel is .091d., for oil and petty stores .011d., and for labor .028d., making a total of .13d. The corresponding figures for the second group are as follows: The average coal consumption is 5.3 lbs., the average price paid for coal is 6s. 4d. per ton, and the average cost per indicated horse-power-hour for fuel is 18d., for oil and petty stores, .01d., and for labor .034d., making a total of .224d. Judging from these average figures the difference between the two groups is not so marked as we should have expected; but this small difference is due in part to the fact that the averages have been calculated from the total horse-power-hours and the total costs of all the factories added together, and as the larger users of power have obtained better results than the smaller users the average figures are proportionately better. If, instead of using this method, we take the coal consumption of each factory, add them together, and then get the average by dividing by the number of factories, we arrive at 10.5 lbs. instead of 5.3 lbs., and we may also note that the heaviest coal consumptions are in engineering works, the actual record figure quoted being for an engineering establishment where the coal consumption amounts to 27.85 lbs. per indicated horse-power-hour, and the cost for fuel, oil and labor to just over five-eighths of a penny. As a further example of the wastefulness of small engines, and of the way in which power users sometimes allow engines to consume steam long after they ought to have been put on the scrap heap, a series of indicator diagrams are reprinted, and the steam consumptions as calculated from them are given as ranging from 53 to 180 lbs. per indicated horse-power-hour, with the additional information that these small engines, which have been in use for about twenty years, are in a factory where the main engines are working with a steam consumption of 14 lbs.

To supplement the information given in the tables referred to above, Mr. Mavor gives particulars of the economical results obtained at a foundry in Glasgow, where 19 small engines were replaced by a gas engine of 120 horse-power, driving a set of hydraulic pumps and a dynamo. The hydraulic gear works lifts, cranes and testing apparatus, whilst the dynamo supplies current to seven motors of various powers for driving cranes and machine tools, and also for lighting a portion of the works formerly lighted by gas and oil lamps. A comparison was made between months, one before and one after the change, in which the output of manufactured product and the work done were the same, and the books show that in the earlier period 566 tons of dross, costing £127, were consumed, whilst in the second period 227 tons of dross and 26 tons of anthracite, costing together £67, were consumed. The net result of the change was therefore a cash saving of £60 per month in cost of fuel, whilst the total saving in working expenses was estimated at from £80 to £100 per month.

Mr. Mavor concludes his paper by some advice as to the best way to effect a change from the old style to the new, so as to show a good return for the capital expenditure from the start. He considers that it is a bad plan to use an old engine to drive a dynamo, or to put down a new engine to take steam from an old low-pressure boiler, and advises that a separate installation of boilers, engines, and dynamos of efficient type should be erected sufficient in the first instance to allow of all the notoriously wasteful isolated engines being replaced by electric motors, whilst leaving untouched any old engines which are working with fair economy, and especially those which are driving groups of machines through shafting. When all the isolated engines have been replaced, and the economy effected by the change is known, the question of how far it will pay to do away with main engines and shaft transmissions and replace them by electrical transmission, can then be safely answered and the change gradually made.

WHAT IS THE HEATING SURFACE OF A STEAM BOILER?*

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It is a fact which is now generally understood by engineers and all who have to do with steam power plants that the power of any boiler, or more accurately the amount of steam which it can furnish in a given time, depends first of all upon its area of heating surface. Of course the amount of steam which a square foot of heating surface will produce varies between very wide limits, and is affected by a multitude of conditions. It is also true that heating surface is no more essential than the means for supplying heat—that is to say, a furnace of sufficient size and grate surface to burn the fuel, and draft sufficient to supply the furnace with the necessary air. The furnace and the chimney, however, are not necessarily parts of the boiler at all; their function is merely to supply the heat, and the function of the boiler proper is to transfer as much as possible of this heat to the water which it contains. Both the amount of heat which it can transfer in a given time and the proportion of the total heat generated which can be transferred vary with the area of the heating surface exposed. In other words, both the capacity and the economy of a steam boiler depend directly upon its area of heating surface.

Evidently, then, the area of the heating surface of a boiler ought to be determined with a fair degree of accuracy. The designer of the boiler must know it, if, with any degree of precision, he is to adapt the boiler to the work which it has to do. The seller of boilers must know it, if he is to be sure of fulfilling his guarantees of capacity or economy; and the purchaser of boilers should know it in order to determine what he is getting for his money. As a matter of fact, a very large proportion of the boilers bought and sold are actually bought and sold by their heating surface. The prices asked for and quoted may be the price per horse-power, but the horse-power is determined directly from the heating surface, the number of square feet allowed to a horse-power varying from 5 to 14, according to the type of the boiler. Again, in comparing the work done by different boilers, the relative heating surface is always taken into consideration.

We need go no further for proof that accurate determination of boiler heating surface is a desirable thing. But we have now to notice the remarkable fact that in computing boiler heating surface, an error of from 7 to 17 per cent. is made by a large proportion of steam engineers and boiler manufacturers. The error to which we refer consists in taking the surface in contact with the water, instead of that exposed to the fire or hot gases, as the heating surface. If the heating surface is flat, of course the areas are the same; but boiler heating surface is in most cases made up of tubes, and the difference between the interior and exterior surface of a boiler tube is as much as 17 per cent. of the interior surface in the case of a 1-inch tube and is about 7 per cent. in a 4-inch tube.

The error arises in the first place from a failure to appreciate the fact that the heating surface exposed to the fire is the actual heating surface of the boiler, on which its capacity depends. A clear understanding of this fact is so important, and it has been and is so generally mistaken by engineers and writers of engineering works, that the writer ventures to submit a discussion of the elementary principles on which this assertion is based.

Suppose we have an iron plate 1 inch thick, on one side of which is flowing a current of hot gas at a temperature of, let us say, 1,000 degrees, and on the other side is a body of water in a steam boiler at a temperature of 300 degrees (corresponding to a gauge pressure of steam of about 52 pounds).

* Paper presented at the Niagara Falls meeting (June, 1898,) of the American Society of Mechanical Engineers.

Now the heat in passing from the hot gas on the side of the plate to the water on the other meets with three different resistances as follows:

(1) Resistance in passing from the gas to the surface of the plate.

(2) Resistance due to the passage through the plate.

(3) Resistance due to the passage from the other surface of the plate to the water.

That one of these resistances which is accurately known is (2), the resistance in the passage through the plate. The heat conductivity of metals has been carefully determined by experiment in physical laboratories, so that if we know the actual temperatures of the two surfaces of a plate and its thickness, we can at once determine how much heat is passing through a unit area in a given time. On the other hand, if we know how much heat is passing through the plate, we can determine what is the difference of temperature of its two surfaces. Let us solve an example of the latter sort: Suppose the plate is transmitting heat enough to evaporate 3 pounds of water per hour from and at 212 degrees per square foot of its area, or about the average rate that the heating surface transmits heat in an ordinary stationary boiler. Since 965.7 heat units are required to transform a pound of water at 212 degrees into steam at the same temperature, the plate will transmit $3 \times 965.7 = 2897.1$ heat units per square foot per hour, or for convenience let us say 2,900 heat units.

Now experiments on the conductivity of metals have shown that an iron plate 1 foot square and 1 inch thick whose opposite surfaces are kept at a uniform difference in temperature of 1 degree Fahr. will transmit in an hour 473 British thermal units.*

Hence to transmit 2,900 British thermal units per hour, the difference in temperature of the two sides of the plate will be $2,900 \div 473 = 6.13$ degrees.

I doubt not it will surprise many to learn that so small a difference of temperature between the two surfaces of an iron plate is sufficient to cause so large an amount of heat to flow through it; but the coefficient for the heat conductivity of iron on which it is based is the result of many experiments by the most eminent physicists, and is accepted as correct by the best scientific authorities, and there is no reason to doubt its accuracy.†

In studying our present problem, however, the exact accuracy of the coefficient is a matter of no particular importance. We just found that boiler heating surface 1 inch thick, when transmitting 2,900 heat units per hour, will have a difference of temperature on its two sides of 6.13 degrees Fahr. But we never have heating surface of such thickness in steam boilers. The shell heating surface in internally fired boilers is seldom over $\frac{5}{8}$-inch thick. Furnaces and fire boxes are made of $\frac{1}{4}$-inch to $\frac{3}{8}$-inch plates, while tube heating surface is from $\frac{1}{16}$ to $\frac{1}{8}$-inch thick. We see then that the actual difference of temperature between the two surfaces of a boiler tube transmitting heat at the rate already named will be from $\frac{1}{8}$ to $\frac{1}{16}$ of 6.13 degrees, or in round numbers from $\frac{3}{8}$ degree to less than 1 degree Fahr. As the eminent physicist Lord Kelvin has said, for all practical purposes we may consider that the heating surfaces of steam boilers conduct heat as if they were no thicker than paper, or as if the metal were of infinite conductivity. It will be seen also that an error of 50 per cent., or even of several hundred per cent., in determining the coefficient of conductivity of iron, even if such an error were probable, would make no practical difference in this conclusion.

There are many facts of practical importance to be drawn from this. For example, in its light we can readily see how little reason there is to expect any greater economy in locomotive boilers with brass

*See Ganot's "Physics," 13th ed., page 378.
†Many engineering text-books and pocket-books still quote Rankine's formula and Peclet's coefficients for heat conductivity; but the latter have been found by the more careful research of modern physicists to have been largely in error.

or copper tubes and fire-boxes than in those of steel. Yet we still hear the superior conductivity of copper urged as a reason why English railways stick to the use of copper fire-boxes.

We know now that the two surfaces of the plate, previously referred to (if we conceive its thickness reduced to that of an ordinary boiler tube), will have only a trifling difference of temperature. Next let us discuss the relative heat-absorbing powers of the water on the one side of the plate and the hot gases on the other. It is to be kept clearly in mind that the temperatures of the two sides of the plate which we have just considered are the temperatures of the skin of the plate itself, which is quite a different matter from the temperature of the air or the water in contact with the plate.

If this is clearly understood, it will be easy to understand that the actual temperature of the plate itself depends on the relative heat-transmitting power of the fluids on its two sides. If these fluids were the same on the two sides, and were at the same temperature and under the same conditions as respects mobility, then the plate temperature would be a mean of the temperatures of the fluids on its two sides. But since water is many times as efficient as air or furnace gases in absorbing heat, the plate temperature will be nearly the same as that of the water and far below the temperature of the hot gases.

This is a fact which is a matter of common knowledge, and yet it has been overlooked by many engineers and by engineering writers; and because it has been overlooked is one main reason why engineers have not always insisted on the fire side of tubes being considered the heating surface of steam boilers.

Let us review some of the facts which show the relative heat-absorbing power of the water and gases. Take an iron rod and heat it to redness, then let it be held still with only the air in contact with it, and see how long a time elapses before it is cool enough to be touched. Heat the rod to redness again and then plunge it in water and again note the time before it can be touched. We have then a very rough approximation of the relative heat-absorbing powers of air and water.

Again, experiments have been conducted to determine the temperature to which a metal plate could be heated when one side was in contact with water. The temperature was determined by inserting in it plugs of various fusible alloys, and the fire side of the plate was then subjected to the most intense heat that a powerful blow-pipe could produce. So long as the water side of the plate was clean, it was impossible to melt the fusible plugs.*

The most striking illustration, however, which the writer has ever seen of the large heat-absorbing power of water, as compared with air, was an experiment conducted by him for another purpose some years ago. A vessel having a single vertical tube of about 2 inches diameter was filled with cold water (45 degrees to 50 degrees Fahr.); the hot gases from a large oil lamp or a Bunsen burner at a temperature of some 1,000 degrees or more were then passed up through the tube. The surface of the tube exposed to the hot gases was kept so cold by water on the other side that drops of dew were condensed upon it from the hot gases, and the interior of the tube became actually coated with dew, which remained until the water was warmed to about 60 degrees. I advise anyone who may not be convinced as to the enormous heat-absorbing power of water as compared with gases to try this simple experiment.

It is very easy to understand why water should have so much greater heat-absorbing power than air. The specific heats of water and air are as 1 to 0.23 for equal weights; but since air at ordinary temperatures weighs only $\frac{1}{812}$ as much as an equal volume of water, if we consider a thin film of air in contact with a hot surface and a film of water of equal thickness and area in contact with a similar hot surface, the water would absorb 3,530 times as much heat as the air if the temperatures of each were raised an equal amount. Again, the relative heat conductivities of water and of air, according to Lord Kelvin, are as 40 to 1. On the other hand, in the transmission of heat from a surface to a fluid, the mobility among the particles of the fluid, whereby fresh portions of it are constantly brought in contact with the surface, is a matter of great importance, and in this respect air, of course, has a considerable advantage.

The writer has been unable to find any trustworthy figures for the relative heat-absorbing power of air and water; and the practical importance of their accurate determination would be trifling, for we know in a general way and from the examples already cited that water absorbs heat very many times more rapidly than air, so many times that in the case of a thin plate, such as a boiler tube, transmitting heat from furnace gases on the one side to water on the other, we can be quite certain that the temperature of the metal plate is at most only a few degrees warmer than the water in contact with it.

In other words, in any steam boiler with clean heating surfaces we can assume the temperature of the fire side of the heating surface to be practically the same as that of the water in the boiler. Perhaps it may be 1 degree more; perhaps it may in some cases be 20 degrees, or possibly 30 degrees more. The difference is of no practical importance, since in the few cases where so large a difference as 20 degrees or 30 degrees may possibly exist, the temperature of the fire to which the surface is exposed is greater by probably 2,000 degrees or more than the temperature of the plate.

If, now, it is clear that the fire side of the boiler tube or flue is at practically the same temperature as that of the water in the boiler, the reader will have little difficulty in comprehending that this surface, and not the surface on the water side, is the real heating surface of the boiler, which measures its capacity of making steam.

The great resistance to the flow of heat in any steam boiler is in getting the heat from the hot gases into the surface exposed to them. Compared with this, the resistance to the passage through the plate and the resistance to the passage from the plate into the water are mere trifles. If we increase the surface exposed to the hot gases, we shall increase the capacity of the boiler to absorb heat; but if we leave this surface the same and increase the surface exposed to the water, the amount of heat transmitted in a given time will be practically the same.

The case can be made still more clear perhaps by an analogy to the flow of water through pipes. If we have a length of 1-inch pipe connected to two lengths of 12-inch pipe, and allow water to flow through them under a head, it is clear that the flow will be determined by the resistance of the 1-inch pipe. If we enlarge that, we shall enlarge the flow; but if we leave that alone and enlarge either or both the 12-inch pipes, the flow will be practically unchanged.

The area of the fire side of the tube is what determines the heat absorbing power and the steam-making capacity of the boiler. If we can cause this to take up more heat in any way, we shall increase the power of the boiler. The Serve tube, with its ribs extending into the hot gases, increases the interior surface of the tube, and thus its capacity for absorbing heat. If, however, instead of putting ribs on the fire side of the tube, we put them on the water side, we increase the surface exposed to the water, but we make no increase of any practical importance in the amount of heat transmitted. In a similar way, the curved form of the tube, which causes the surface exposed to the water to be greater than that exposed to the fire (in fire-tube boilers), effects no increase in the amount of heat transmitted. The real heating surface, which determines the amount of heat transmitted, is the surface exposed to the fire.

In the preceding discussion it has been supposed that the heating surfaces were clean on both sides. As a matter of fact, heating surface is almost invariably more or less coated with soot or ash on the fire side and with scale on the water side. If the preceding discussion has been carefully followed, it will be clear that the transfer of heat will be much more interfered with by the deposits on the fire side than by deposits on the water side. To use again the analogy of the water pipes, a half-closed valve in the 1-inch pipe would have far more effect than a half-closed valve in the 12-inch pipe. It is no part of the purpose of this paper to excuse lack of care in keeping boilers free from scale; but it is nevertheless quite certain that a thin scale on boiler tubes does not interfere in any noticeable degree with the capacity or economy of a boiler, while the coating of the fire side of the tubes with a flocculent deposit of soot does certainly interfere in a marked degree with a boiler's steam-making capacity. Of course, a thick scale on the water side of tubes or other heating surface, or any other material which acts as a non-conductor, may considerably obstruct the flow of heat. If it does this, the temperature of the heating surface itself will at once be raised, and may reach a point, as happens sometimes with the shells of externally fired boilers and with the furnaces of marine boilers, where the metal may be so heated as to bulge or buckle.

It may be worth while in this connection to administer a puncture to that hoary fraud which has been repeated in technical literature and trade catalogues "ad nauseam." I refer to a table purporting to give the loss of economy in percents for each one-sixteenth-inch of scale upon the heating surface of a boiler. In view of the fact that there are many varieties of boiler scale, varying widely in porosity and heat conductivity, and remembering that the thickness of scale in different parts of a boiler is never uniform, it hardly needs the discussion above to show the utter absurdity of this ancient "fake."

Another deduction of practical importance from the fact just set down, is that so far as the transmission of heat after the boiler is making steam is concerned, the circulation of the water in boilers is of a good deal less consequence than has been sometimes claimed. I do not mean by this that it is not worth while to make proper provision for circulation. There are possibly some parts of boilers worked with forced draft, such as the tube-plates of marine boilers, where it is so difficult for the steam bubbles to get away fast enough that we have a mass of foam instead of water in contact with the plate. Under such conditions, of course, the plate is bound to be heated; but I know of no evidence that this is any other than a rare occurrence, even in boilers which are pushed most severely. If anyone is inclined to stick to the old hobby that circulation is of great importance to economy, I advise him to consider the conditions in the narrow water space (about 3½ inches wide) around a locomotive fire box, where the steam rushing up is directly opposed by the water going down. Let it be understood that I am referring to circulation only as affecting the transfer of heat and the consequent economy and capacity of the boiler. Good circulation is desirable to prevent unequal heating of the boiler, and consequent straining, and it may be of service in preventing deposits of scale and mud in places where they are least desirable; but that it has any appreciable effect on economy and capacity is not proved, and probably cannot be.

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* It may be well to point out that this method of determining the maximum temperature reached by the plate is subject to more or less error on account of the obstruction to the passage of heat from the plug to the metal of the plate (the plug being merely embedded in the surface of the plate and not passing entirely through it). Any joint between two metal surfaces interferes with heat conductivity just as it does with electrical conductivity. The amount of interference depends upon how intimate the contact is between the metals, the amount of oxides (if any) between them, etc.

It has been demonstrated above that the surface exposed to the fire is the real heating surface of a steam boiler. Is there any good reason why this should not be generally adopted by engineers as the correct, and the only correct, method of computing heating surface?

The following are some reasons, good or bad, which are likely to be urged against this:

1. The makers of fire-tube boilers will claim that this gives the water-tube boiler makers an advantage. With the same number of tubes in a boiler, of the same length, the water-tube boilers can show 7 to 11 per cent. greater heating surface. This is of course true; but is it not an advantage to which the water-tube boilers are fairly entitled? It must be remembered that nowhere in this discussion has it been claimed that there was any fixed heat transmitting value for heating surface. On the contrary, it is entirely certain that a square foot of heating surface in one type of boiler may have double the heat transmitting power of an equal area in another. Again, the relative facility with which heating surface can be cleaned of soot and ash counts for a vast deal, more than most steam users are accustomed to think. It certainly seems that the makers of fire-tube boilers have enough valid arguments to offer for their product without demanding the privilege of overstating their heating surface by 7 to 11 per cent.

2. Another argument offered for the use of the exterior surface as the heating surface is that this makes a given boiler show a larger heating surface than if the interior were taken. However much the argument may appeal to boiler manufacturers—and I hardly think they will take it very seriously—it deserves no weight with engineers. A foot rule is no longer for calling it 13 inches.

3. It is urged that practice is and has in the past been fairly uniform in accepting exterior area as the heating surface, and it is best to stick to a uniform practice, even if it be in error, than to change. If the practice were actually uniform, there might be reason in this argument; but while the majority of engineers probably use the exterior surface of tubes in computing heating surface, there is a very respectable minority which insists on the correct method of computation, and this minority shows no signs of decreasing.

4. As the outside diameter of the tube is even inches and the thickness of tubes varies, it is easier to compute the exterior heating surface than the interior. Probably this is one of the principal reasons why the outside surface has so frequently been taken; but in these days of tables and pocket-books and aids to computations, so trifling a matter as computing the interior area of a tube ought not to be an excuse for perpetuating an error. As a matter of fact, it will generally be less labor to do this than it is to figure the cost of the tubes with the numerous series of discounts which are frequently found on hardware bills in these days.

It appears to the writer that none of the arguments which have been cited in favor of computing the exterior surface of tubes as their heating surface are sound enough to justify engineers in perpetuating this error. If, however, for the sake of uniformity or ease of calculation, it should be thought best to use the exterior surface of tubes in computing heating surface, the fact that this is not the real heating surface ought to be kept clearly in mind. Misconception and wrong ideas on this point have been responsible for not a few mistakes and absurdities in the design of steam boilers.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

ALUMINUM MANUFACTURE, WITH DESCRIPTION OF THE ROLLING-MILLS AND FOUNDRY AT MILTON, STAFFORDSHIRE.*

BY E. RISTORI.

On the occasion of the meeting of the Institution of Mechanical Engineers at Belfast in July, 1896, Mr. James Sutherland, the manager of the factory at Larne, read a paper which fully described the method adopted for the preparation of pure alumina (oxide of aluminum) from bauxite. Members who then visited the factory will be interested to learn that the British Aluminium Company have already been compelled to enlarge the works to nearly double the capacity, and that great improvements have since been introduced into the process of manufacture. The finished product is a very finely divided powder, and in order to ship it safely to Foyers, it has been found advisable to pack the alumina in hermetically-sealed steel drums. On arrival in Scotland, the oxide is reduced by the Héroult process, and the metal is run out of the electrolytic baths into ingot molds. In this form the aluminum is quite pure enough for certain purposes, such as foundry work and steel making; and much of it is therefore sold without further treatment. But as small quantities of the cryolite—a double fluoride of aluminum and sodium containing 13 per cent. of aluminum—which is used as a solvent during the electrolysis, occasionally become mixed with the metal as it comes out of the furnace, the aluminum at this stage is scarcely suitable for the production of tubes, rods, etc. The original crude ingots are, therefore, sent to Milton, in Staffordshire, where they are remelted and refined until the metal attains a purity of 99.6 per cent.

Milton Works.—The site of the Milton Works, which the members will have an opportunity of visiting, is well selected in the middle of an industrial district; it is connected with the North Staffordshire Railway by a siding, and has a frontage on the Trent and Mersey Canal. The works were the first erected in the United Kingdom for the production of aluminum by electrical agency. They were erected by the Cowles Syndicate for the purpose of turning out aluminum and aluminum bronze by the well-known "Cowles" process; but before the British Aluminium Company took them over they had already stopped making aluminum, having been previously driven out of the field by the competition of the electrolytic methods, which were greatly assisted by the employment of cheap water power. It was found useful, however, to convert this factory into a rolling-mill and foundry, with the idea not only of refining the Foyers ingots, but also of working them up into sheets, rods, and large or small castings, more convenient for the different trades that use aluminum. A portion of these works which was not required for the above purpose was sublet to the Epstein Electric Accumulator Company, who have been making and charging their accumulators here for the last three years. This portion includes two tubular boilers and one engine of 650 IHP.

Casting-Shop.—The casting-shop, erected in 1895, is situated close to the rolling-mills, and contains a series of 11 furnaces for 500 lb. pots, connected by a large flue to the main chimney, 125 ft. high, which gives a good draught for melting large quantities of bronze in a short time. This shop can deal with about 40 tons of aluminum per day in the shape of ordinary commercial notched bar, half-round stick for steelmakers, slabs for rolling, tube billets for drawing, wire billets, both round and shaped, for various purposes. When casting the metal it is sometimes necessary to add a little cryolite or some similar flux for assisting in the liberation of the impurities, which then rise to the surface as scum. These refining furnaces are fired with soft coke, because aluminum does not require such a high temperature as is necessary for bronze. The scum taken from the top of the pots is again remelted very slowly, in order to recover all the aluminum; it then forms a whitish powder, containing practically nothing but the cryolite and some carbon, and being quite suitable for use in the Héroult reducing cell is sent back to Foyers for further employment. An overhead traveling crane is used for lifting the ingot molds and pots. Experiments have been made in casting slabs and billets with a side runner, which seems to offer certain advantages.

Foundry.—The principal building, which was originally intended by the Cowles Syndicate to be an engine and dynamo house with outside boilers, is 200 ft. long by 65 ft. wide and 20 ft. high under the principals. A portion of this is now used as a foundry, and contains two large core ovens, each 16 ft. by 23 ft., having a door 14 ft. by 10 ft. high, fired with coke fires under the floor; a cupola; two series of crucible furnaces to hold 500 lb. pots; and two traveling cranes, sufficient to handle weights up to 15 tons, which so far have been sufficient for all the foundry work up to bronze castings of five tons weight and aluminum castings of two tons. A considerable extension of the plant is contemplated. In making bronze castings the metal is not poured straight into the mold in the usual way of casting iron, but into a runner box, or for a large casting into a number of runner boxes, having holes in the bottom corresponding with the gates of the casting. During the time the metal is being poured into the runner box these holes are filled with iron plugs until all the metal is in the runner box; the plugs are then taken from the holes, so that the metal runs into the gates of the casting from the bottom of the runner box, and leaves the scum behind in the box or in the top of the gates. In making castings of aluminum, it is not sufficient to use runners of the same size as those usually employed in making brass and iron castings. As the shrinkage of aluminum is about three times the shrinkage of ordinary gun metal, a considerable amount of trouble is experienced if the runners and risers are not large enough to allow the casting to continue to be fed during its shrinking by the runners or risers connected with it.

Rolling-Shop.—The rolling-shop measures 130 ft. by 60 ft., and is covered with a weaving-shed roof having a north light. At present it contains two pairs of rolls 18 in. diameter by 42 in. width, one pair 18 in. diameter by 48 in. width, one pair 18 in. diameter by 20 in. width, one pair 14 in. diameter by 20 in. width, one pair 14 in. diameter by 30 in. width, and a new pair of friction rolls 22 in. diameter and 60 in. wide is in process of erection. All are driven by gearing from a horizontal tandem compound-condensing engine, put up in 1896. This engine runs at 60 revolutions per minute, and has cylinders of 21 in. and 40 in. diameter and 40 in. stroke, and is capable of driving still more machinery. The steam is supplied by a Lancashire boiler 8½ ft. diameter and 30 ft. long, placed at the side of the house. The driving gear consists of helical-tooth wheels, 12 in. wide and from 6 ft. to 9 ft. diameter, driving the rolls at about 10 revolutions per minute. The 14 in. rolls are both fitted with a friction wind by Messrs. Jones, of Birmingham, with which strips as fine as 0.0005 in. have been successfully rolled to a length of from 69 ft. to 90 ft. The rest of the plant required in a rolling-mill is also contained in this building. It includes a guillotine shearing machine for ½ in. plates, 8½ ft. wide, a crocodile machine for plates up to 1 in. thick, two circular cutters, one for the manufacture of disk blanks 9 in. to 24 in. diameter up to 14 S.W.G., or 0.085 in. thick, the second up to 4 ft. diameter and ⅛ thick, which are sold for stamping purposes; a steam-

* Paper read before the Institution of Mechanical Engineers, Derby, Eng.

hammer, for closing the grain and for strengthening alloys before they are rolled into sheets, is in an adjacent building. A press is also being prepared for punching disks up to 12 in. diameter. Two annealing furnaces or muffles are also provided, 5 ft. by 12 ft. and 7½ ft. by 14 ft. These are a most important item in the plant for either rolling or hammering metal. Slabs 24 in. wide by 1¼ in. thick are broken down hot, after being heated in the muffle. They are afterwards again heated when necessary between the successive passes to reduce them from 1¼ in. thick to ¼ in. Most of the rolling itself is done cold; and in some cases, especially when very pure aluminum is used, even the breaking down can be done cold. Connected with the rolling-mill is a pickling-shop containing tanks 12 ft. by 3 ft. charged with caustic soda, water, nitric acid, sulphuric acid, etc.; the pickling process is an important step in the rolling of aluminum, and has to be carried out whenever a good polish is required on the finished sheets, while it is also equally adapted when a matt surface is desired.

Fitting-Shop, Testing Machine and Laboratory.—The fitting-shop is sub-divided into several buildings, and is provided with a quantity of ordinary lathes, circular and band saws, a nicking machine, shaping machine and a number of small presses for cutting blanks out of sheet metal. In another building next to the rolling-mill there is a cold saw to cut metal 20 in. thick, especially used for cutting heads off aluminum bronze castings which cannot be handled or cut up in any other way. If the bronze is made hot, it can be forged into any shape. Most of it has a tensile breaking strength of 30 to 35 tons per square inch, and it is useless trying to handle the heads in any other way than by sawing. The Milton factory contains also a 30-ton Wicksteed testing machine, in which the different bronzes and light aluminum alloys are constantly being tested. There is also a chemical laboratory in which the sample tappings from the furnaces at Foyers are analyzed and records preserved, so that the purity of any particular delivery can always be ascertained. The whole works are lighted electrically from two dynamos, and a motor is kept ready for occasional assistance in driving the machinery.

Working of Aluminum.—With certain limitations, imposed by the chemical and physical peculiarities of the material, aluminum can be worked much like the other industrial metals handled at the present day. It is best melted in sand or in iron crucibles, without the addition of any flux, at a temperature not greatly exceeding its melting point, 655 deg. C. = 1,210 deg. F. On a larger scale the operation can be carried out at a dark-red heat on the bed of a reverberatory furnace lined with basic magnesia bricks of good quality. In casting, special precautions must be taken to allow for the great shrinkage during cooling. The molds should have large risers and plenty of vents. They are preferably cooled from the bottom upwards to enable the gases to escape. Slabs for rolling must be cast in closed ingot molds with a perfect machined internal surface which is coated all over with graphite and water; the molds must be very hot, and the castings cooled quickly in very cold water to make them soft. Aluminum can be forged hot or cold, preferably at a temperature which causes a hard wooden stick to smoke when pressed against the metal. In comparison with other metals it ranks third in order for malleability and sixth for ductility; sheets have been hammered as thin as $\frac{1}{40000}$ in., and wire can be drawn down to $\frac{1}{250}$ in. diameter. No lubricant should be used for rolling, and the aluminum requires frequent annealing at a low red heat just visible in the dark. In turning, the edge of the tool soon becomes blunt unless only small cuts are taken; the cutting speed should be high, and both tool and metal should be lubricated with turpentine or petroleum. Filing is best done with single-cut files because cross-cut files rapidly become choked. Spinning is easy on wooden or metal forms, the best lubricant being stearic acid dissolved in turpentine. Aluminum can be stamped or pressed, hot or cold, either dry or with soap water, for heavy work, and with tallow for small goods. Frosting is effected by dipping the articles for a few seconds in a hot 10 per cent. solution of caustic soda, containing about 2½ per cent. of common salt, till the surface turns black, then brushing in cold water and dipping in strong nitric acid till the metal becomes white again, and finally washing and drying in sawdust. This process is desirable before aluminum surfaces can be efficiently painted or enamelled. For polishing, a mixture of olive oil and rum is used, or emery and tallow, followed by rouge and turpentine. Burnishing is done with bloodstone or steel dipped in rum and oil, or in a solution of borax containing a little ammonia. To engrave aluminum the plate must be coated with stearic acid and turpentine or with rum and oil as before; if this be not done the graver slips continually.

Alloys of Aluminum.—Among binary alloys especially it has been found that, as the proportion of the two ingredients becomes more and more equal, the products lose their valuable qualities, and that the industrial alloys may be broadly separated into two kinds—namely, "light" alloys containing 90 to 99 per cent. of aluminum with 10 to 1 per cent., or even less, of some other metal or metals, and "heavy" alloys, containing 1 to 10 per cent. of aluminum with 99 to 90 per cent. of the other components. They can, therefore, be regarded either as pure aluminum strengthened by the addition of some other metal, or as one of the older metals improved physically and chemically by the addition of aluminum. A considerable amount of attention has consequently been devoted at Milton to the preparation of different sorts of alloys, some of which may be briefly referred to.

Light Alloys of Aluminum.—In its purest form aluminum is very soft and not of great service in those arts in which much rigidity and strength are required. For this reason a metal containing only 98.5 to 98.8 per cent. of aluminum, the impurities being silica and iron in almost equal proportions, is preferred to a metal of 99.6 per cent. purity. One casting alloy, having a specific gravity of 2.9, is largely used just now, and is known as "No. 6." Its composition is still kept secret. It has been found to produce remarkably clean castings, which require very little machining to finish up; it takes a high polish, and so far has given complete satisfaction. Another alloy is "No. 4," which contains nothing but aluminum and a small proportion of copper; it is not one of the materials generally recommended, though it has some good qualities. There is a strong suspicion that when aluminum is alloyed with copper galvanic action is set up between the two, especially when the alloy is exposed to salt water; therefore this is not recommended in any quantity for outside positions. The two alloys particularly recommended as among the best yet made are called "Wolframinium" and "Romanium." These are both ternary alloys, and next to the aluminum, tungsten is the leading ingredient in each. In one of them copper is present to a small extent, in the other nickel, and both have given astonishing results as regards strength and elongation. Samples of rolled sheet or rods made of these alloys have shown as much as 20 to 22 tons tensile strength per square inch, with 5 to 10 per cent. elongation in 4 in., which is remarkable when the low specific gravity of the material is taken into consideration. The above are all so-called "light" alloys—that is, alloys containing a preponderating percentage of aluminum with only a small quantity of another metal or metals.

(To be continued.)

Help to fight the Electrical Trust by subscribing for ELECTRICITY.

CATHODE JETS.*

BY. C. E. S. PHILLIPS.

A Crookes tube in which the pressure has been so far reduced as to make it difficult for a discharge to pass, provided also that the negative electrode is suitably placed in a bulb of soda glass, often appears speckled with a number of vivid green flecks when strongly excited by the discharge from an induction coil. Sometimes, too, such an appearance is noticeable in the case of a highly-exhausted focus tube.

Considerable uncertainty, however, seems to exist as to the origin of these irregular green patches that form upon the inner surface of the glass, and while to day they are generally thought to be due to an emission from the cathode itself, the question does not appear to have been very definitely settled experimentally. In order, therefore, to demonstrate that the cathode is capable of emitting a radiation which can produce these effects, a glass bulb was blown and an aluminum disk sealed into it.

The disk, loosely placed upon a spindle and free to rotate, was held in position by two brass nuts; from its edge there projected a fine glass rod to the opposite end of which, by means of platinum wire, a small piece of thin sheet iron was securely attached. Such an arrangement afforded a means of rotating the cathode disk by the application of an external magnet.

The anode was placed in the side tube through which the bulb was exhausted. With this apparatus the best conditions for producing the green flecks were found to be: (1) a low pressure within the tube—sufficient to ensure an emission of X-rays, or, at any rate, a general fluorescence of the glass; (2) sudden stimulation; (3) particular spark length, and (4) a dry atmosphere.

It should be pointed out that, in the particular tube used, the cathode disk was somewhat roughened at its edge. Under favorable circumstances upon stimulating this tube and obtaining the well-known glow of golden-green upon the inner surface of the glass, a few vivid patches soon made their appearance; the magnet was then applied, and both cathode and patches moved one with the other.

Care was taken in this, as in subsequent experiments, to determine the extent of the direct action of the magnet upon the green spots, and in all cases that was found to be comparatively negligible. But it was further noticed that the patches would often remain luminous after the discharge had ceased to pass in the tube, and in some cases, curiously, even when the connecting wires were removed from the apparatus, and with both electrodes earthed, the patches still continued to glow for as long as 10 secs. When the magnet was applied as before it was interesting to observe that such patches moved as they did when the discharge was passing—a result indicating that even under these conditions, and when no free charge resided upon the electrodes, there was still a jet of electrified matter issuing from the cathode.

In the course of this work the writer noticed that it was possible to deflect these cathode jets both electrostatically and magnetically, and that the direction of such deflection in the latter case, for a given pole, corresponded with the deviation observed in the green-producing rays of the cathode stream under similar circumstances.

The flickering green patches were also easily obtained by using an ordinary sewing needle as the negative electrode, and when making use of such an arrangement, it was seen that occasionally a large green patch—say the size of a three-penny piece—could be scattered and broken up into a number of smaller spots by suddenly increasing the potential difference between the electrodes. Moreover, when an arcing or some such disturbance was caused to take place between a jet-emitting cathode and an-

* From the *Electrician*, London.

other body placed very near to it and also within the tube, all patches immediately disappeared from the glass. It was found as well that placing tinfoil upon the outside of the glass near to the cathode prevented the formation of the jets. May not these facts go some way to account for the curious variation in the nature of the X-rays referred to by Mr. Porter and others, when spark gaps were placed in series with the focus tube, or metal caps placed round the outside of the glass in the neighborhood of the cathode? Such a device would, in view of the above results, be expected to influence the tendency which there appears to exist for the cathode to give off jets from its edge, and indirectly in this way to modify the nature of the focused stream from that electrode. It should be understood, however, that a spark gap arranged in series with the tube did not appear to materially affect the formation of the green spots, but since a particular potential difference at the electrodes, together with suddenness of stimulation, are important factors in the matter, it appears reasonable to conclude that the tendency of the cathode to emit the jets would, under such circumstances, certainly be affected to some extent.

At any rate it is probably important to see that the concave cathodes of focus tubes have a fine polish, particularly at their edges, and especially if they are to be placed in highly exhausted bulbs for the production of X-rays.

Electrically Produced Phosphorus.

The electric furnace has enabled of phosphorus being successfully produced in several different ways. One method consists in heating a mixture of phosphate of lime and coke, the two ingredients first being finely powdered. On the mass becoming pasty, the openings of the furnace are sealed, except one through which the vapor passes, which is then collected and distilled in the usual way.

CANADIAN NOTES.

Ten months' earnings of the Montreal Electric Street Railway amount to $1,179,284.63. For the same period last year the earnings of the railway were about $100,000 less. During the month just closed, the figures are unprecedented, over $144,000 having been collected, giving an increase of about $15,000 over the corresponding month last year.

It is reported that the Ottawa Electric Railway Company is negotiating for the purchase of the Gatineau Valley Railway and will convert that road from steam to an electric railroad. The country through which this line passes is of the grandest in Canada, and it is in the Gatineau Valley that the famous fishing grounds are situated.

Nelson Moore of Guelph, Ont., has completed a model of his overhead electric railway. The hardwood posts from which the cars are suspended, as well as the base and the arms, are incased in steel and strongly riveted to prevent vibration. The iron sockets are suspended from the arms of the post and into these steel rails are laid. The wheels of the car are built after the manner of bicycle wheels, with steel spokes and ball bearings, which gives strength and lightness and ease of motion. The framework of the car will be of strong iron or steel, and the car is suspended from the wheels to a distance of three feet from the ground. The interior is fitted with back-to-back seats which run the entire length through the middle and are suspended from the top. The inventor claims many advantages for his overhead road. No grading or ground work has to be done in constructing the road; no bridges are required to span streams or cross ditches and ravines—a material consideration. Then in the winter time there would be no clearing away of snow from the tracks, and for the same reason no washouts. Mr. Moore claims that less electric power would be required to operate the cars in comparison with the present systems, that greater speed would be obtained and more effective locomotion secured.

LONDON NOTES.

[From our London Correspondent.]

Electricity for the "Underground."

The directors of the much-abused Metropolitan Railway Company have now made an official announcement regarding their intentions in the matter of electrical equipment. The want of ventilation of the underground tunnels has been a trouble to the company for many years past, and negotiations have repeatedly been opened with English and foreign electrical men and promoters with a view to working the lines electrically and thus overcoming the ventilation difficulty. These negotiations have failed to come to a satisfactory conclusion until within the past month or so. The latest and official intimation is that the Metropolitan and Metropolitan District railway companies (which in places traverse the same lines) have agreed for an experimental working by electricity of a portion of their line situated between High street, Kensington and Earl's Court stations. The estimated cost of the experiments is about $100,000, which will be borne in equal proportions by the two railway companies. It has been stated that the trials will extend over about two years, by the end of which period it is expected that there will be additional experience of the Waterloo & City electric line, which has just been opened, and probably others as well.

Middlesbrough (Eng.) Electric Trams.

What is considered by English engineers one of the most important, if not *the* most important piece of electric tramway work of the past year or two, has just been completed and opened. The line connects the towns of Middlesbrough, Thornaby and Stockton. For English work the lines have been very rapidly constructed, the entire permanent way of fifteen miles of track being completed in less than six months. For a distance of six and one-half miles the track is double and for two miles single. The tracks are laid on a 3-foot 6-inch gauge and paved with whinstone and granite sets and with scoria blocks. The steel rails, in 30 to 36 feet lengths, are 6-inch girders, 92½ lbs. to the lineal yard. The rails are longitudinally bonded with double copper bonds (Columbia 0000), and at intervals of 120 feet the tracks are also cross-connected by copper. The gradients are not particularly difficult, though at one point they are 1 in 18. The overhead wire method is employed, center poles being used for certain roads within the town of Middlesbrough, while all the remainder of the route is fitted on the side pole and bracket system. The trolley wires are of 000 hard drawn copper .364 inch diameter and divided by sectional insulation. There are overhead points and crossings at the ends of the lines and at the branches leading into the main and sub-stations. Section pillars are placed at each half mile section on the road. They are about 4 feet high and are placed on the curb lines. They are fitted with switches, for cutting out a section of the trolley line or feeder as may be desired without interfering with other parts of the line. The motor cars are mounted on four-wheeled bogie trucks of the maximum traction type, each truck carrying one G. E. 800 motor, a k2 series parallel controller being fixed at each end of the car.

The main power station has been erected at Stockton-on-Tees. In the boiler room there are three Babcock & Wilcox water tube boilers, each having a heating surface of 3,580 square feet and being capable of evaporating 12,000 lbs. of water per hour. Each boiler furnace has a Vicars mechanical stoker worked by an electric motor. There is a 240 tube Green economizer used. The engines are three in number and are of the Reynolds-Corliss horizontal cross-compound condensing type of 400 HP. each. These were made by Messrs. Allis & Co. of Milwaukee. They have cylinders 16″ x 32″ x 36″ stroke. Each engine runs at 94 revolutions per minute and is directly coupled to a 300 KW. three-phase generator. The condensing and pumping plant is arranged on the basement floor, and all steam, condenser, suction and other pipes and connections being also carried below the floor line, a clear space is thus obtained round the engines and generators. The three alternators are 32 pole, 2,500 volts, giving a frequency of 25 cycles at 94 revolutions per minute. The fields are excited from the 500 volt bus-bars. To supply light when the machinery is at a standstill and also to start the dynamos a battery of Tudor cells has been provided, consisting of 260 cells with a discharge rate of 48 to 70 amperes, the capacity at the lower discharge being 240 ampere-hours. A booster is connected in series with the 500 volt bus-bars for discharging these cells. It consists of a rotary converter fed from step-down transformers of special design. Each transformer has the primary and secondary separated to give the effect of a considerable reactance, this arrangement giving a large range of voltage on the rotary converter to provide for the alteration in the charging volts required by the cells. The rotary converters consist of direct-current generators, to the armature winding of which connections are made at suitable points to a set of three collector rings on the end of the shaft opposite that occupied by the commutator. The same winding serves both for alternating current led into the machine and for direct current taken out. A 500-volt continuous current direct from the rotary converters in the main station feeds the overhead conductor for two miles on either side of the station, while the Middlesbrough and Linthorpe sections are fed by a current transmitted at 2,500 volts from the main station to the sub-station at Newport where it is transformed down to 500 volts for the line. The feeder cable consists of two concentric cables having three conductors of .0775 square inches area. With this small section it is possible to transmit 300 KW. with less than 5 per cent. loss. The two four-pole rotary converters of 200 KW. capacity running at 750 revolutions per minute, in the main power house, feed direct into the portion of the lines from that point and three similar machines are located at the sub-station from which distribution is made to the remainder of the system. At the station there is a combination of static and rotary transformers for charging the batteries, the charging current being passed through the rotary and the voltage raised from 500 to 650 volts for charging. As there are no direct-current primary generators in the power house, a rotary converter was designed to supply the difference between the line voltage and the variable voltage required for charging. Combined with this was a static transformer having a ratio of transformation of 330 volts to 80 volts on a non-conductive load. The transformer was designed with a large amount of leakage between the primary and secondary, the leakage being adjusted so that by changing the phase of the armature current by variation of the field current of the booster the transformer ratio is varied and consequently the voltage on the collector rings. In this way it is possible to vary the voltage on the continuous side of the rotary from 40 volts to 150 volts. The charging current is 60 amperes. The armature of the rotary is designed to carry 60 amperes continuously.

The Middlesbrough & Stockton line is owned and operated by the Imperial Tramways Company, whose managing director and engineer, Mr. J. Clifton Robinson, C. E., M. I. E. E., has been so actively connected with the equipment of other English and Irish lines with electric traction. The installation of the electrical plant has been specially supervised by Mr. H. T. Parshall as consulting engineer for the contractors.

LEGAL NOTES.

A dismissal on the trial of Thomas Taylor's suit against the Nassau Electric Railroad Company, Brooklyn, N. Y., for damages for his ejectment from one of its cars, has been reversed by the Second Appellate Division. A car on which Taylor had taken passage had become disabled, and it was detained for repairs. Taylor, unwilling to wait, boarded another car, after he was cautioned by an officer of the company that he would be required to pay a new fare. Refusing to do so, he was forced to leave it. He had shown that the delay caused by the condition of the car he first took resulted in a loss of $4, through his failing to keep an engagement in New York. Justice Woodward, who gave the opinion, though holding that plaintiff could not recover damages for ejection, said there must be a reversal because it was shown he was damaged in the sum of $4. "The plaintiff," the court said, "entered into a contract with the defendant to carry him between two points upon the line of railroad operated by the defendant with reasonable speed and in safety. The fact that one of the cars operated by the company met with an accident did not give the plaintiff any new rights. The defendant had a right to transfer him to another car if it thought proper to do so, but because of the fact that the defendant did not elect to do this, the plaintiff gained no right to transfer himself. The defendant, by refusing to make the transfer, took upon itself the responsibility for its breach of contract. The plaintiff had notice that he could not retain his seat in the second car of the defendant upon the original payment of his fare, and the company by neglecting or refusing to carry him within a reasonable time simply became answerable for the damages which he sustained by reason of the failure of the defendant to carry out its contract."

At Saginaw, Mich., on the 25th ult., in the case of the city of Saginaw vs. the Union Street Railway Company, the Saginaw Consolidated Street Railway Company and the Boston Safe Deposit & Trust Company, and the Boston Safe Deposit & Trust Company vs. the Saginaw Consolidated Street Railway Company et al., testimony was taken and a decree of foreclosure granted. In the case of the Boston Safe Deposit & Trust Company, trustee, vs. the Saginaw Consolidated Street Railway Company and Union Trust Company of Detroit, the decision dismisses the injunction and provides that the property shall not change hands until all of the indebtedness of the companies to the city shall be paid, and permits the running of cars on all lines.

The American Street Railway Association Convention.

The following card addressed to members of this Association has been sent to us for publication:

CHICAGO, Aug. 1, 1898.

Dear Sir: I desire to remind all our members that the next meeting of this Association will be held at Mechanics' Association Hall, Huntington avenue, Boston, Mass., September 6, 7, 8 and 9, 1898. We expect to have the largest Convention we have ever held. Papers will be read on live subjects. The exhibits will be a prominent feature of the meeting. Full particulars in regard to hotels, railroad rates, etc., were given you in circular of May 1. In order to secure reduced fare you *must* get a certificate from the agent when you purchase your railroad ticket. Headquarters at Hotel Brunswick. Hoping to have your company represented, I remain yours very truly,

T. C. PENINGTON, Secretary and Treasurer.

The American Association for the Advancement of Science.

The annual meeting of the American Association for the Advancement of Science will be held at Boston from August 22 to 27. The meeting promises to be an important one as a number of well-known scientists are expected to be present. The electrical department especially will be ably represented, and a number of important papers on electrical subjects are announced in the programme. The headquarters of the council, which will meet on August 20, will be the Copley Square Hotel.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING PLANTS.

Boston.—The roof of the new power house of the Boston Electric Light Company, in process of construction in South Boston, collapsed at 5:55 P. M. on the 29th ult., burying six men under a mass of iron, brick and timber. Two of them were taken out dead and the other four were badly injured. Three different theories regarding the cause of the accident have gained credence. One is that the immense iron crane used for hoisting machinery and which is supported on the outer wall of the western section and the brick dividing wall was so heavy that its weight weakened the support to the roof. Another theory is that the fire brick between the girders, which was only protected by a thin layer of tarred paper and laths, absorbed so much water during the rain the three preceding days that the weight could not be borne. Still another reason suggested is that the heat expanded the iron work to an unusual degree, which caused it to give way. The Building Commissioner is investigating the matter.

Cleveland, Tenn.—The Cleveland Water & Electric Light Company's plant has been purchased at receiver's sale by W. W. Cunnyngham for $36,500.

Duluth, Minn.—Last week we gave an estimate, handed in by City Engineer McGilvray, of the cost, etc., of a 500 arc light plant under city operation, which amounted to $27,710. Mr. William Burgess, in a letter to the "Herald" shows that the city engineer's estimate is misleading and the figures altogether too low. "To maintain a municipal electric lighting plant of 500 arc lamps, distributed to light the city to advantage," Mr. Burgess says, "will cost as follows: One superintendent, $1,800; one chief engineer, 1,200; one assistant, 900; two firemen, 1,440; two oilers, 1,440; two dynamo tenders, 1,440; one repair man, 900; two linemen, 1,800; one night foreman, 960; two inspectors, 1,440; nine trimmers, 6,480; maintenance of horse and wagon, 300; incidentals, including oil and waste, 1,200; coal, 8,000; carbons, 4,500; depreciations, 4,500; interest on 150,000 at 4 per cent., 6,000; maintenance of poles, wires and lamps, 2,000; insurance on 60,000 station, 960; liability insurance, 1,000; one bookkeeper, 720; making a total of $48,980. Divide this by 500, the number of lamps, and it gives you a net annual cost of maintaining a lamp of $97.96. This estimate is based on arc lamps of 1,200 candle power and a modern up-to-date plant. Should old style apparatus be used it would increase the cost of maintenance. The locating of the plant would also have its effect on cost of operation. The writer has placed the cost of building a plant of this size at $150,000, which is not sufficient to build an economical up-to-date plant." Mr. Burgess adds that he "has figured on the best economy in operating, which is seldom found in municipal lighting."

Ellisville, Miss.—The establishment of an electric light plant is in contemplation by the authorities of this town.

Framingham, Mass.—A committee appointed to investigate the electric lighting system has reported against the purchase or establishment of a municipal plant. They say the price the town is paying for its lights under contract appears to be about the average price paid by other municipalities for similar service.

Hampton, Va.—W. J. Payne of Richmond has closed an option for the purchase of the plant of the Chesapeake Light & Power Company. It is presumed the electrical machinery in the plant will be added to and the plant be converted into a power house for propelling the cars on the new electric railway, in which Mr. Payne is also heavily interested.

Kokomo, Ind.—A cylinder exploded at the power station of the Citizens' Electric Company on the night of the 28th ult., killing George Dunning, the engineer, and badly damaging the plant.

San Bernardino, Cal.—The proposed consolidation of all the electric and gas plants from Redlands to Los Angeles, including the transfer of the San Bernardino Company to the Redlands Electric Power Company, has failed for the present as far as the San Bernardino Company is concerned, owing to a raise in the assessments by the county officials. A new schedule of prices has been issued that raises the price of gas from $3 to $4 per thousand and for incandescent lights $1 per month for all night, 75 cents until midnight, 60 cents to 10 o'clock and 50 cents to 9 o'clock. This is a raise of 100 per cent. in some cases. The arc lights are $9 per month for all night, $7 to midnight, and $6 to 9 P. M.

South Norwalk, Conn.—Commercial electric lighting under municipal ownership was formally introduced in South Norwalk on the 1st inst., when the incandescent lamps of the new system were turned on for the first time and burned throughout the evening. It is the only municipal commercial plant in the State, although South Norwalk has lighted its streets for three years. The new order of things has met with considerable opposition from the private company established in Norwalk and an injunction is now pending.

Sycamore, O.—This village has decided to have an an electric light plant and waterworks system, and expects to have both in operation within eighty days.

STREET RAILWAYS.

Akron, O.—Suits for damages, aggregating $105,000, were begun here on the 1st inst., against the Akron, Bedford & Cleveland Railway and the local street railway for injuries received by the tipping over of a car near Silver Lake, June 21. Mrs. Schumacher asks $50,000; Mary Rankin, $50,000 and Jennie Shepard, $5,000. All live in Akron.

Albany, N. Y.—The State Railroad Commission on the 3d inst. granted an application of the Third Avenue Railroad Company of New York for permission to change its motive power to underground electricity on all the lines now operated by cables. The Commission on the same date granted the application of the Peekskill Traction Company for permission to construct an electric street railroad in Peekskill. The road will run to the State camp and thence to Verplanck's Point.

Auburn, Mass.—The Worcester & Webster Electric Railway Company has accepted the franchise granted by the Auburn selectmen, and engineers are at work on the survey.

Berlin, N. H.—The Railroad Commissioners have made a favorable report on the petition of the Berlin Street Railway Company for a charter for an electric railway in Berlin and Gorham. The report will go to the court for approval. The proposed road will be 5½ miles long.

Birmingham, Ala.—The North Birmingham steam dummy line is being converted into an electric road and work will be pushed so as to have the line ready for operation by October 1. There is every reason to believe that the day is not far distant when the Highland Avenue & Belt Railroad will be transformed into an electric line. Then only one steam dummy line will penetrate the city, and that line is more of a railroad than dummy line, being the one which goes to Bessemer.

Boston.—The Railroad Commissioners have approved the plans of Engineer Kimball of the Boston Elevated system so far as they show the proposed form and method of construction of the stations and approaches thereto, the track system with walls and band rails, also the contact rail and guard. The cars are to be run by electricity by the "third rail" system, only the contact rail, instead of being in the center of the track, is placed outside, elevated slightly above the track rail. Between the tracks the entire length of the road will be a platform on which passengers may walk in case of accidents, etc.

Chagrin Falls, O.—The Cleveland & Chagrin Falls Electric Railway Company has a large gang of men and teams at work just east of town on the extension of its line through Geauga County, which will be known as the Chagrin Falls & Eastern. The entire right of way to Burton, 18 miles into the country, has been secured, and the company announces that the line will be completed early in September.

Charleston, S. C.—The new electric railroad of the Charleston & Seashore Railway Company, running from Mt. Pleasant to the Isle of Palms, has been completed and was opened to public traffic on the 29th ult. Connection is made with Charleston by a ferry boat furnished with all modern appliances.

Delaware, O.—After four attempts, made at different dates, to sell the Delaware Street Railway at public auction, Receiver Cone finally succeeded on the 30th ult. in disposing of the property at public sale. It was bought by B. W. Brown and others of this city for $13,525. The road originally cost $40,000 and was appraised at $15,905.

Elizabeth, N. J.—Among the bids submitted on Thursday last to the Union County Board of Freeholders for a franchise for a trolley line on Westfield avenue (the proposed boulevard) from Elizabeth to Plainfield, was one for $250,000, signed by John Kean, acting in the capacity of president of the Elizabeth City Horse Railroad Company. Another bidder offered $200,000. The franchise is to extend seventy-five years. The freeholders are to meet on the 10th inst. to act upon the bid.

Fairfield, Me.—The route planned by the engineers for the Benton & Fairfield Electric Railroad has been approved by the Railroad Commissioners and the road will be built at an early day.

Flushing, N. Y.—A new trolley company has been formed to build an electric road from Flushing to Jamaica, and to connect several villages on the south shore of Long Island. At Jamaica a connection will be made with the road running to Far Rockaway, with extensions leading to Hewletts, East Rockaway, Lynbrook, Rockville Centre and Freeport. The capital stock of the company is $150,000, and the corporation will be known as the Flushing & South Shore Railroad Company. The directors are William F. Brown, William L. C. Allen, Louis E. Freeman, Francis S. White, Edward J. Boyle, George A. Hamilton, William J. Howson, Matthew J. Kearney and J. H. Gibson.

Great Barrington, Mass.—A trolley line to run from Canaan to Great Barrington through New Marlboro is now proposed. A part of the route has already been surveyed, and it is of easy grade. It will pass through several villages which at present have no communication with the larger towns except by private teams or a daily stage.

Hackensack, N. J.—The block in the extension of trolley transit through Bergen County, caused by the inability of the Bergen Traction Company to pass through Englewood to the west and by the obstructions

to trolley schemes encountered in Hackensack, is now to be removed, and a step taken which, in a few years, will result in the joining of all the Bergen County towns with those of Passaic, Essex and Hudson Counties as well as with New York City, via Fort Lee ferry, by electric cars. Right of way has been obtained for a trolley line within the limits of Hackensack.

Hamilton, Ont.—Municipal ownership of the street railway did not succeed at the election in Hamilton on Wednesday last. One of the reasons given by the "Spectator" was that the property owners did not desire to trust the city council with the running of the railway.

Havelock, Neb.—The proposition submitted by the Lincoln Traction Company for a street railway in this town was carried by a large majority at an election called for the purpose.

Lansing, Mich.—The Michigan & Indiana Railway Company, which will connect Benton Harbor, St. Joseph, Niles, Berrien Springs and other points in Berrien County, filed articles of association on the 27th ult. The new company has obtained right of way through all the townships from St. Joseph to Niles.

Lawrence, Kan.—Representatives of Chicago capitalists have been looking over the ground here and have held several conferences with leading citizens with a view to the construction of an electric street railway in the city, and the probability is that a line will soon be built.

Montclair, N. J.—The North Jersey Street Railway has opened the new branch of their system giving Montclair and Caldwell connections. The completion of this line makes it possible to take a moonlight ride these hot nights from the terminals of the system in Jersey City and Newark to points in the Passaic Valley famed for their beauty.

Nantasket, Mass.—The new Nantasket trolley road in which President Andrew Radel of the Bridgeport, Conn., Traction Company is chiefly interested, was auspiciously opened last week. The road is to be 60 miles in length, 10 miles of which have been completed.

Owosso, Mich.—E. M. Hopkins of Chicago, acting as the representative of an Eastern syndicate, has succeeded in arousing earnest interest among citizens of means in Vernon and the other towns concerned in the proposed electric road to be known as the Caledonia, Venice & Vernon Electric Railway, and the project seems reasonably certain of being carried out. The proposed line runs east from Corunna and south through Vernon into Durand. The road will run through a rich and prosperous farming country and promises to be a profitable investment. Combined with the Owosso & Corunna Traction Company's line, there will be about eighteen miles of track.

Petersburg, Va.—The city council at its meeting on the 1st inst. adopted an ordinance giving the Piedmont Traction Company of Charlottesville, Va., the privilege to construct and operate a street electric railway on certain streets in this city. Under the ordinance the company is to begin the construction of the railway within six months.

Portland, Me.—The Portland and Yarmouth Electric Railway has been completed and cars are running. The road runs through eight miles of beautiful scenery and will become very popular with Portland people as a pleasure trip.

Richford, Vt.—The electric railway from this town to Montgomery, for which a charter has been granted, has many warm advocates in both places and the promoters are sanguine of its success. It may probably be built this fall.

Tonawanda, N. Y.—The electric locomotive for use on the Buffalo & Lockport line has arrived in this city from the General Electric Car Works at Schenectady, and will soon be put in use for drawing freight along the new electric line. It is double ended and in appearance resembles an ordinary yard engine.

MANUFACTURING, ETC.

Cleveland, O.—The recent fire at the Lincoln Electric Company's works here did considerable damage, but did not disable the company to such an extent as to prevent an early resumption of its business. The company has obtained more commodious quarters in the World Building on Ontario street, and is already in full operation and prepared to take care of all orders.

Fond du Lac, Wis.—The Central Operating & Construction Company is a new corporation which has been organized in this city with Maurice McKenna, C. D. Smith and Menzo Smith as incorporators. According to the articles of incorporation the company's plans are to cover a wide territory. It is to include a water works system, a gas and electric lighting plant, a street railway and a boat line on Winnebago lake.

Iron Mountain, Mich.—Detroit capitalists are erecting a plant near here for the making of steel billets and pig iron direct from the ore by a secret process. They claim it can be done at a very small percentage of present cost. If the furnace is a success it will revolutionize the iron business and give a market value to many millions of tons of lead ore on this range. The demonstration furnace, together with engine and electric motor, will cost $12,000.

New York.—The "Journal of Commerce" says: "Orders for upwards of $12,000 worth of electrical supplies and three large pieces of metal working machinery for Genoa, Italy, have just been received by a merchant in the Chesebrough Building. The volume of business in manufactured articles that could be developed with the Italian market, it is believed by those in a position to know, is not thoroughly appreciated by American manufacturers. The question of extending credit to Italian merchants need not be considered; make your wares known in that market and advise importers there to send their orders through exporters or bankers here. The quantity of American goods taken into Italy through German and English merchants ought to be fully realized in order that merchants and manufacturers here should know what the proportion of the business is. As to this, one of the few Italian exporters expressed himself yesterday, saying that there are many needs which could be supplied directly from here to the Italian market just as advantageously as from Europe."

Philadelphia.—The Pennsylvania Manufacturing, Light & Power Company, which recently purchased the Hestonville Railway Company's power house at Twenty-fifth and Callowhill streets, is making arrangements for enlarging the station and converting it into one of the largest power plants in the country.

Washington, D. C.—Commercial Agent Stern at Bamberg, Germany, writes that the United States electric machinery (Walker Company, Cleveland, O.,) used in the electric street railway of Bamberg is giving entire satisfaction. This means a good deal, the Consul says, considering that one of the largest works for electric engineering in Germany (Schuckert, at Nuremberg,) is within close proximity.

TRANSMISSION PLANTS.

Vineland, N. J.—Capitalists and business men are forming a company to dam Muddy Run, four miles from here, for the purpose of furnishing electric power for manufacturing purposes and lighting the town with electricity.

COMPANY MATTERS.

Cincinnati.—The Cincinnati, Hamilton, Middletown & Dayton Street Railroad Company has changed its name to the Mill Creek Valley Street Railroad Company. L. C. Weir is president and O. B. Brown secretary of the corporation.

Hoboken, N. J.—The Hudson Electric Light Company of Hoboken is reported to have passed into new hands. The controlling stock in the company was formerly held by the General Electric Company and a few foreign stockholders. B. M. Shanley, president of the Consolidated Traction Company; Myles Tierney, president of the North Hudson County Railway Company, and E. F. C. Young, president of the North Jersey Street Railway Company, are said to be among the new owners. The company supplies Hoboken and the towns in the northern part of Hudson County, N. J., with electric lights.

Philadelphia.—Thomas Dolan, president of the United Gas Improvement Company, has purchased a controlling interest in the West End Electric Company for the Pennsylvania Manufacturing Light & Power Company of which he is a director. The fact that Mr. Dolan made the purchase gave rise to a report that the West End had been acquired by the United Gas Improvement Company, and that it was a preliminary move to an early absorption of the Pennsylvania Company by the United Gas Company. There is not, Mr. Dolan states, the slightest truth in the latter report, nor is such a consolidation now in contemplation.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—On September 1 the new law enacted by the last session of the Legislature in regard to transfers will go into effect. This law provides that no transfer ticket over anything giving the right of transfer from a public conveyance operated upon a line route of a surface railroad or from one to another of the same line shall be issued, sold or given except to a passenger entitled thereto, and any person who shall so give, sell or receive and use such transfer shall be guilty of a misdemeanor.—The State Railroad Commission has granted the application of the Frankfort & Utica Railway Company permission to use the overhead electric trolley on its proposed line from Utica to Frankfort.

Schenectady, N. Y.—An employee of the General Electric works by the name of Swartz was recently killed by electricity as the result of stepping on the experimental third rail electric railway of the company. He tripped and fell across the rails in such a way as to complete the circuit and receive through his body a continuous current of 500 volts. His death was instantaneous.

Troy, N. Y.—The report of the Troy and New England Railway Company shows assets of $372,500, including $370,532 for cost of road and equipment. The liabilities include $189,000 capital stock and $183,900 funded debt.

ELECTRICIANS IN THE WAR.

New York.—The First Regiment of Volunteer Engineers, Col. Eugene Griffin commanding, has finally received orders to proceed to the front. The regiment embarked on Thursday last on the troopship Chester. They go to Porto Rico, and Col. Griffin said he expected to report to Gen. Miles by Friday of the present week. The officers and men of the regiment were much pleased at the prospect of soon getting within range of the Mauser rifle.

PERSONAL AND MISCELLANEA.

Harry A. Ward of Oneonta, N. Y., a graduate of the class of '98 in the course of electrical engineering at Cornell University, has been appointed superintendent of the Oneonta & Otego Valley electric road.

Most of the Maine electric roads have abandoned the plan of hiring an insurance company to stand its losses for it in case of accident whereby patrons are injured. When this system first went into vogue in the State, the rates were low and the trolley companies were anxious to hire this sort of protection. But after a year or two of experience with the cases that came up, the insurance companies rose on their rates in most drastic fashion.

M. Henri Moissan has succeeded in obtaining metallic calcium free from impurities. He dissolves the crude metal in molten metallic sodium, maintained at a red heat. On cooling, the calcium crystallizes and is separated by being treated with absolute alcohol. The crystals are white and shining and belong to the hexagonal system.

Capt. Clement A. Griscom, Jr., son of Clement A. Griscom, president of the International Navigation Company, who has recently returned from Cuba, met with a painful and peculiar accident in Washington, D. C., on Wednesday last. While in an F street business office his right hand came in contact with a rapidly revolving electric fan and one of the fingers was completely severed.

In reply to a letter from Miss Helen Miller Gould of the Women's National War Relief Association, inquiring whether there was anything in the way of supplies or apparatus that would contribute to the comfort of the sick and wounded on board the hospital ship Missouri, Major Arthur, surgeon in charge, said that four electrical kitchens were needed, the cost of which, he thought, would be between $500 and $1,000 each. Miss Gould at once informed Major Arthur that the association would furnish them. The Missouri is being fitted up at the foot of Amity street, Brooklyn, N. Y.

The Belt Line railroad, by which the trains of the Baltimore & Ohio Railroad runs through Baltimore, was rendered impassable for hours a few nights ago by the falling of a portion of the overhead electrical construction. The break occurred on both sides of the bridge at Huntingdon avenue. It was just about 9 o'clock when about 500 feet of the conductor, weighing perhaps seventy-five tons, with its supporting cables, broke loose from the giant supports, and fell with a tremendous crash, which was heard for several squares. When the conductor came in contact with the earth a brilliant electrical display was the result. There is a signal tower just west of Huntingdon avenue, and the operators were startled at seeing great electric sparks leaping from one switch lever to another. A warning was immediately sent in to headquarters, the current was turned off at the Howard street power house and Engineer W. T. Manning was soon on the scene with a wrecking crew, which worked during the greater part of the night to raise the heavy conductor and secure it to the giant support and trusses.

In about two months, says the Washington correspondent of the N. Y. "Herald," some miniature models of our battle ships and cruisers are to be placed in the experimental tank just finished at the Washington Navy Yard to the end that the speed and power of the big boats themselves may be accurately ascertained. "For," said Mr. William Denny, one of the most progressive and well informed Scotch shipbuilders, "the truth is that of all the problems about a steamship the only one at the present moment incapable of being solved by a priori methods in extreme cases is that of speed and power. No ability and no training will enable even the most skilful naval architect to overcome the want of an experimental tank in coping with these questions." The tank just completed is 500 feet in length and 50 feet in width, with water space of 475 by 43 feet and a depth of 14 feet.

RECENT COMPANY ELECTIONS.

Portsmouth Gas & Electric Light Company, Portsmouth, N. H.—President, H. Fisher Eldredge, to fill the vacancy caused by the death of his brother, Marcellus Eldredge. Calvin Page was elected a director.

Consumers' Light, Heat & Power Company, Elizabeth, N. J.—President, Albert B Carlton; vice-president, ex-Mayor John C. Rankin, Jr.; secretary and manager, A. H. Stephens. All the officers are residents of Elizabeth.

St. Albans Street Railway Company, St. Albans, Vt.—President, Col. E. C. Smith; clerk and treasurer, F. S. Stranahan; directors: H. M. Stevens, Col. E. C. Smith, W. B. Fonda, A. O. Brainerd and F. S. Stranahan.

Amesbury Electric Light, Heat & Power Company, Amesbury, Mass.—Directors: Dr. J. F. Spaulding, Salisbury; Dr. B. H. Young, Dr. J. Douglass, James Bakie, Jr., Ezra C. Morrill, Charles Goss, Amesbury, and Harrison Rowe, Kensington, N. H. Dr. Young was elected treasurer of the company.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

INCORPORATIONS.

The National Light & Power Company, New York—to manufacture the necessary apparatus and solutions for producing electric currents. Capital stock, $10 000, with the privilege of increasing the same to $5,000,000. The shares are $100 each, and are held by Edward S. Savage, Rahway, N. J.; M. D. Valentine, Woodbridge, N. J.; A. W. Sherman, Brooklyn, N. Y.; Albert Burns, The Bronx, N. Y., and A. L. Sherer, New York City.

The Sandusky & Interurban Electric Railway Company, Cleveland, O.—to build and operate an electric railway through Erie, Huron and Lorain counties, Ohio, connecting lines already in operation. Capital stock, $500,000. Incorporators: H. A. Everett, E. W. Moore, B. Mahler, C. H. Stewart and W. H. Price.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 2, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

608,178. Electrical Rail-Bond and Method of Securing Same in Place. William R. Cock, Plainfield, N. J. Filed Dec. 7, 1897.

608,258. Electric Bond for Railway-Rails. Samuel H. Harrington, New York City. Filed Dec. 10, 1896.

608,281. Trolley. Frank P. Case, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed June 30, 1897.

608,301 and 608,302. System of Train Control. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Dec. 31, 1897, and March 26, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

608,259. Electric-Arc Lamp. Charles A. Pfluger, Chicago, Ill. Filed Aug. 7, 1895.

608,497. Electric Headlight Lamp. Harlan P. Wellman, Ashland, Ky. Filed Dec. 10, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

608,191. Apparatus for Producing Traversing Motion of Overhead Traveling Cranes. John G. Fiegehen and Edward G. Fiegehen, Bedford, England. Filed Dec. 24, 1897.

608,246. Electrical Signaling Apparatus for Transmitting Commands. Conrad Arldt, Berlin, Germany. Filed Dec. 29, 1897.

608,249. Alternating-Current Induction-Motor. Charles S. Bradley, Avon, N. Y., assignor to the General Electric Company of New York. Filed Oct. 22, 1895.

608,277. Armature for Dynamo-Electric Machines. Edward H. Anderson and David P. Thomson, Schenectady, N. Y., assignors to the General Electric Company of New York. Filed Jan. 8, 1898.

608,299. Commutator. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 27, 1898.

608,307. Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed July 14, 1894.

608,308. System of Electrical Distribution. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Original application filed July 14, 1894. Divided and this application filed May 22, 1897.

608,309. Regulating Dynamo-Electric Machines. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 23, 1898.

608,310. Automatic Switch for Regulating Electric Air-Compressors. Moss Moseley and Philip Funck, Rochester, N. Y.; said Funck assignor to said Moseley. Filed Nov. 15, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

608,333. Telegraphic Transmitting and Receiving Apparatus. Bernhard Hoffmann, Paris, France, assignor to Societe de International Telescriptor Syndicat, Limited, London, England. Filed May 5, 1897.

608,389. Rapid Telegraphic Transmission on Cable-Lines. Charles L. Davies, London, England. Filed June 25, 1896.

608,504. Telephone-Transmitter Arm and its Attachment. William J. Barr, Ashtabula, Ohio. Filed Oct. 30, 1897.

MISCELLANEOUS.

608,175. Reciprocating Electric Bell. Herman Casler, Canastota, N. Y. Filed March 18, 1898.

608,211. System of Heating by Electricity. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed Nov. 16, 1892.

608,216. Battery-Zinc. Dora Ogden, Columbus, Ind. Filed April 12, 1897.

608,224. Galvanic Bath. Carl E. Schnee, Carlsbad, Austria-Hungary. Filed Sept. 14, 1897.

608,231. Insulating-Caster and Electric Switch Combined. Augustus W. Slayton, Tecumseh, Mich. Filed May 18, 1898.

608,300. Electrolytic Apparatus. John G. A. Rhodin, Eccles, England. Filed Aug. 11, 1897.

608,319. Electromechanical Lock. Henry G. Carleton, New York City. Filed Sept. 9, 1897.

608,320. Electric Combination Lock. Henry G. Carleton, New York City. Filed April 4, 1898.

608,321. Electric Lock. Henry G Carleton, New York City. Filed May 24, 1898.

608,322. Combination Mechanism for Electric Locks. Henry G. Carleton, New York City. Filed June 18, 1898.

608,343. Electric Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed April 6, 1895.

608,412. Joint for Electric Conductors. Herbert S. Patten, Montclair, and William Maver, Jr., Jersey City, N. J., assignors to themselves and Charles L. Heins, New York City. Filed Dec. 31, 1897.

608,415. Device for Recording and Reproducing Music. Ernest K. Adams, New York City. Filed March 26, 1897.

608,473. Apparatus for Preparing Cards for Use in Jacquard Machines. Robert G. McCrum, Armagh, Ireland. Filed June 2, 1897.

608,496. Coin-Controlled Medical Battery. Nelson M. Watson, Detroit, Mich. Filed Dec. 27, 1897.

608,537. Battery-Electrode. Henry E. Wilkinson, Mount Vernon, Ohio. Filed June 10, 1897.

TELEPHONE AND TELEGRAPH.

Two Bell Defeats.

Judge Hagner, at Washington, D. C., on the 4th inst., rendered a decision against the Chesapeake & Potomac Telephone Company in the first $50-rate case. The Judge granted James H. Manning a temporary injunction restraining the telephone company from taking its instrument from his place of business. Manning proffered the company a quarterly installment of rent under the $50 rate recently ordered by act of Congress. The company refused, demanded its old rental and threatened to take out its 'phone unless Manning paid up, and Judge Hagner held that the act of Congress was constitutional and that, pending future legal action, the company must furnish its service at the rate prescribed by the new law. The Manning case is but one of a score or more, and was made a test. The telephone company filed notice of an appeal.

Judge Showalter of the United States Circuit Court, Chicago, last week refused the injunction asked for by the Western Electric Company to prevent the Kellogg Switchboard & Supply Company from installing a switchboard for the Kinloch Telephone Company of St. Louis which the plaintiff claimed was an infringement. Judge Showalter denied the injunction on the broad ground that the Kinloch Company in St. Louis had spent over $1,000,000 already in fitting up its plant and that the company was engaged in a public service. He also ruled that the defendant, as a solvent corporation, would be able to answer to any damages if it should be proven later that they had infringed upon the plaintiff's alleged patent. The Judge, however, took occasion to declare that, in his opinion, there was nothing new in the Firman patent, on which the suit was based. Judge De Haven, of the United States Circuit Court for the Northern District of California, recently decided that the patent was valid, but the case was appealed to the United States Circuit Court of Appeals, where the defendant expects to reverse it. The Chicago decision means that the Kinloch Company will be able to go ahead with its switchboard work.

In Crawfordsville, Ind., a struggle for supremacy is being waged by the Central Union Company against the Harrison Telephone Company. The former uses the automatic system and has maintained a nominal plant in Crawfordsville for several years, with about a dozen subscribers. The Harrison system was put in about two years ago by local capitalists, and at once built up a large business. Lately the Central Company announced its intention of entering the field in earnest on a large scale. This at once engendered discord and the Harrison Company succeeded in inducing the council to annul the franchises of both companies and to grant them new ones, providing, among other things, a schedule of rates, the Harrison Company claiming that if the Central Union succeeded in freezing it out the rates would be inordinately raised. The Central Union refused to accept the new franchise, and declared that the council had no right to revoke its old franchise. An attempt to erect additional poles was made by the Central Union, when the Mayor stepped in and stopped the work, and the company has taken the matter to the courts.

A dispatch from Carlisle, Pa., states that the stockholders of the Cumberland Valley Telephone Company (recently incorporated with a capital stock of $50,000, ten per cent. of which is paid in) have named these new directors: D. K. Appenstellar, H. B. McNulty, Isaac Lesher, Dr. J. O. Skinner, E. M. Smith, W. L. Minnick, D. L. Grove, Chambersburg; John Zullinger, Orrstown; O. C. Gelwicks, St. Thomas. The board organized by electing D. K. Appenstellar president, Dr. J. O. Skinner vice-president, H. B. McNulty secretary, Dr. David McLay treasurer. Work will be commenced next month. The line will extend to all points in Franklin and Cumberland counties.

The Chicago "Inter Ocean" states that "the Chicago Telephone Company is considering the question of introducing the 'measured rate' system of charges. For some time the directors have been discussing the system, now in operation in Greater New York, Philadelphia, Boston and Buffalo, with a view to adopting it wholly or in a modified form in Chicago. At the same time some of the aldermen have been talking of presenting an ordinance to secure lower telephone rates for the small users. Superintendent Ellicott of the department of electricity has discussed the new plan with Comptroller Waller, and both agree that it would be a popular change in the company's methods of doing business."

J. A. Helvin, promoter of the new underground telephone system in Chattanooga, Tenn., is gratified over the interest found among the business people of the city in his undertaking. He has already secured several subscribers, and has received encouragement from everyone whom he has seen in regard to the new system.

A telephone system is to be established at Sycamore, O.

Independent Telephone Companies, Notice.

The recent decision in Pittsburg against the bridging telephones made by the Western Telephone Construction Company of Chicago has no bearing on the American Electric Telephone Company's bridging telephone; in fact, it leaves the American telephones about the only non-infringing multiple system in existence.

Moral: Do not rush into trouble. Buy American apparatus. AMERICAN ELECTRIC TELEPHONE CO.

The corporation attorney of St. Paul, Minn., has advised the committee on police of the council that the contract with the Northwestern Telephone Company, by which fifty-five telephones are furnished to the police department, can be terminated with thirty days' notice. Superintendent King has recommended that the telephones can be purchased at $5 each, while under the present arrangement with the telephone company the department pays an annual rental of $5 per year for each instrument.

I. L. Withers, W. D. Melton, J. P. Matthews, F. H. Weston and J. F. Livingston, the promoters of the new telephone exchange which it is purposed to establish in Columbia, S. C., are meeting with success in their canvass for subscribers. On the first day they secured over 100 signatures. Nothing will be done looking towards the building of a plant until 350 subscribers have been obtained. The promoters think they will have no trouble in getting that number.

It is said that the Government of Victoria, Australia, proposes to substitute iron and steel instead of wood for the 80,000 telegraph poles now erected in the colony. Provision for the first installment of 5,000 posts has already been made in the estimates for the next fiscal year.

The Phoenix Electric Telephone Company, of which George W. Sutton of New Rochelle is president, has applied to the trustees of Mamaroneck, N. Y., for a franchise to maintain a telephone line within the village limits. The company has already received a franchise in New Rochelle.

The Ripley Telephone Company of Ripley, Chautauqua county, N. Y., has been formed with a capital stock of $12,000. One of its principal directors and promoters is Assemblyman S. Frederick Nixon.

An effort is being made on the part of the town authorities of Pocomoke City, Md., to establish a complete telephone system, connecting Pocomoke with all the important towns on the Eastern Shore. Several have taken stock in the new enterprise, and the project is meeting with much success.

The Atchison Telephone Company of Atchison, Kan., a new concern, has elected the following officers: George Storch, president; J. T. Hersey, vice-president; S. A. Frazier, treasurer; E H. Berry, secretary. Mr. Berry will also manage the company.

The Colorado Telephone Company has begun service on its new toll line from Leadville to Granite via Twin Lakes. It is believed that later a line will be built between Canon City and Granite, thus giving Leadville another complete telephone line to Denver.

Manager Burt of the Missouri & Kansas Telephone Company announces that the line between St. Louis and Kansas City will be completed in from 30 to 60 days. The line when completed, will, he says, be as fine as any in the East.

The Bell Telephone instrument statement for the month ended July 20 shows: Gross output, 21,551; returned, 10,011; net output, 11 540. In the same month in 1897 the gross output was 15,859; returned, 7,241; net output, 8,618.

The Smithville, Tex., "Times" says that "an electrical supply firm of New York, through its State agents, is investigating the feasibility of putting in a telephone exchange in Smithville."

Since the change of administration in Portland, Ore., the Columbia 'phones have been taken out of all of the engine-houses in the city and the Oregon 'phones have been installed in their stead.

The village council of Alexandria, Minn., has granted the Alexandria Telephone Company the right to put in a telephone system.

Salida, Col., is to have a telephone system. The franchise has been secured and the work of setting poles and stringing wires will commence within ninety days.

A telephone exchange has been established at Albia, Ia.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Aug 8.						
Albany Ry. Co.	100	2,000,000	$1,750,000	1½ % Q., Feb. '98.	144	145
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	68	70
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown, Pa.—Aug 8:						
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Aug. 8:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	85	..
Baltimore, Md.—Aug 8:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	..	72½
aBaltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23⅛	23⅜
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—Aug 8:						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	...	..
North Shore Traction Co. com.	100	4,000,000	4,000,000	....	10½	12
North Shore Traction Co. pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	76	78
b West End Street Ry. Co. com.	50	10,000,000	9,085,000	4 % S., Oct., '[illegible]	86¼	86½
b West End Street Ry. Co. 8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '[illegible]	105	106
Boston Elevated R. R.	100	10,000,000			66½	67
Brooklyn N. Y.—Aug 8:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	205	209
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	61½	61¾
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR. guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	214	214½
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	205	209
Kings County Elevated	....	4,750,000	4,750,000	....	4	6
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	..	...
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Aug 8:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	....	55	60
*Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q. Dec., '97.	80	81
Columbus O.—Aug 8:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	49	50
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Aug 8:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co.	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Aug 8:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	8 % Q., Dec. 31, 97.	270	272
Chicago & South Side R. T. RR.	100	10,823,800	10,323,800	....	..	..
Lake Street Elevated RR.	100	10,000,000	10,000,000	....	12½	18
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	....	..	2½
Met. West Side El. const. stk.	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Jan., 98.	210	217
hNorth Chicago City RR.	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co.	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	93½	94¼
jChicago West Div. Ry. guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry. guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Aug 8:						
Cincinnati Inc. Plane Ry. com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co.	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	114¼	114½
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Aug 8:						
Akron, Bed. & Clev. Elec. Ry.	100	1,000,000	1,000,000	¾ % Jan., '98	37	39
Cleveland City Ry.	100	8,000,000	7,600,000	¾ %., Oct., '97.	62¼	63
Cleveland Electric Ry.	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	60	61
Detroit, Mich.—Aug 8:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co.	....	250,000	250,000	....	..	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry.	100	250,000	200,000	....	100	110
Dayton O.—Aug 8:						
City Railway Co. com.	100	1,500,000	1,470,600	1¼ % Q., Jan 1, '98.	100	102
City Railway Co. pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	150	155
People's Street Railway	...	1,100,000	....	....	100	..

*Unlisted. †Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Aug 8:						
Hartford Street Ry. Co.	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	—
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	—
Holyoke Mass.—Aug 8:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—Aug 8:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70	—
Indianapolis, Ind—Aug 8:						
**Citizens' Passenger Ry	....	5,000,000	5,000,000	....	27	30
Lancaster, Pa.—Aug 8:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000	....	..	—
Lancaster & Col. Electric Ry.	....	....	87,500	....	..	—
West End Street Railway	....	....	....	....	..	—
Louisville, Ky.—Aug 8:						
Louisville Ry. com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	34	39
Louisville Ry. 5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	96	100
Minneapolis, Minn.—Aug 8:						
Twin City Rapid Transit com.	100	17,000,000	15,010,000	....	18	23
Twin City Rapid Transit 7 % pfd.	...	8,000,000	1,714,200	1¾ %. Jan., '98.	..	100
Montreal, Canada.—Aug 8:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	...	..
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1¼ % S., J. & J.	97	97½
Memphis, Tenn.—Aug 8:						
Memphis Street Railway Co.	100	500,000	500,000	....	15	—
New Haven, Conn.—Aug 8:						
Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co.	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	..
Winchester Avenue RR.	25	1,000,000	600,000	....	40	42
New Orleans, La.—Aug 8:						
Canal & Claiborne RR. Co.	40	240,000	240,000	4 % S., Jan., '98.	[illegible]	170
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	[illegible]
New Orleans Traction Co. com.	100	5,000,000	5,000,000	....	1	3
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000	....	6	9
aCrescent City RR. guar.	100	2,000,000	2,000,000	8 % S., Jan., '98.	..	32
bNew Or. City & Lake RR. guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	8	88
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	18	[illegible]
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	58	54½
New York—Aug 8:						
Central Crosstown RR.	100	600,000	600,000	2½ % Q., July, '97.	[illegible]	..
cChristopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Jan., '98.	150	160
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98.	[illegible]	170
dMetropolitan Street Ry. Co.	100	30,000,000	30,000,000	1¼ % Q., Jan., 98.	1[illegible]9	..
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	32	[illegible]
fBroadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	216	220
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98.	1[illegible]0	..
hEighth Avenue RR.	100	1,000,000	1,000,000	....	347	[illegible]
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q., Feb., '98	[illegible]6	..
jNinth Avenue RR. guar.	100	800,000	800,000	....	170	1[illegible]0
kSixth Avenue RR. guar	100	2,000,000	2,000,000	....	200	[illegible]
lTwenty-third St. R. R. Co. guar.	100	600,000	600,000	4½ % Q. Feb., '98.	330	..
Second Avenue RR.	100	2,500,000	1,862,000	2 % Q., Jan., '98.	177	180
Third Avenue RR.	100	12,000,000	10,000,000	2 % Q., Feb., '98.	175	178
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	58	62
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Aug 8:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	49½	50
Newark Passenger Ry.	100	6,000,000	6,000,000	....	..	.
nRapid Transit Street Ry.	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Aug 8:						
Allegheny Traction Co.	50	500,000	500,000	....	44	..
oConsolidated Traction Co. com.	50	15,000,000	15,000,000	2 %, Jan., '95.	15¾	16
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	3 %, May, '97.	53¾	..
pCentral Traction Co.	50	1,500,000	ǁ900,000	....	...	...
qCitizens' Traction Co.	50	3,000,000	‡3,000,000	6 % A.	62½	...
rDuquesne Traction Co.	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co.	50	2,500,000	1,900,000	3 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	..
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	ǁ2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	..	22
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 97.	..	..
Second Avenue Traction Co. com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co.	50	300,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ǁ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds..

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October,

s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Aug 8						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	158
Northampton, Mass—Aug 8						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	168	175
Omaha, Neb.—Aug 8:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Aug 8:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	85	86
Providence, R. I.—Aug 8:						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	60	64
Philadelphia.—Aug 8:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	43½	45
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	538,900	‖538,900	3 % S—July, '98.	65⅝	66
aFairmount Pk. & Had. Pass. Ry.	50	800,000	300,000	3 % Feb. 1, '98.	65	66
Union Traction Co............ $12½ pd	50	30,000,000	29,930,450	....	19¼	19⅞
bElectric Traction Co	50	....	8,297,920	....	71¾	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha's A—Apr.98	390	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	‖771,076	$9 share A, Mar. 98	256	..
ePeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	185¾	..
hGreen & Coates Passenger Ry	50	500,000	‖150,000	3 % Jan., 1898.	135	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	92	93½
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	..	..
jContinental Pass. Ry......guar.	50	1,000,000	‖580,000	$6 share—July, '98.	142½	..
Empire Passenger Ry. Co	50	600,000	‖600,000	....	..	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	175	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90¼	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	288	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	275	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	28C
Rochester, N. Y.—Aug 8:						
Rochester Railway Co	100	5,000,000	5,000,000	....	9	12
Reading, Pa.—Aug 8:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	64	..
St. Louis Mo.—Aug 8:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % July, '98.	125	127
National Railway Co	..	2,500,000	2,479,000	1½ %, July, '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '93.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	800,000	50c., Dec., '89.	..	..
Southern Electric Ry..........com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry.......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	110	112
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	54	56
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—July.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	107	108
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅜	53¾
Presidio & Ferries RR	100	1,000,000	550,000	....	...	8½
Scranton, Pa —Aug 8:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	..	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Aug 8:						
Springfield Consolidated Ry	100	750,000	750,000	....	....	11
Springfield O.—Aug 8:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—Aug 8:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—Aug 8:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	97	97½
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.		
Washington, D. C.—Aug 8:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	73¼	75
Columbia Ry. Co	50	400,000	400,000	6 % A.	76½	78
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	..	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	121	123
Worcester, Mass.—Aug 8:						
*Worcester Traction Co.........com.	100	8,000,000	8,000,000	....	15	17
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	94½	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Aug 8:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 8:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., July, '98.	278	279
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	71	71½
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Feb. '98.	134½	135
New York.—Aug 8:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	95½	96¼
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	103½	104
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	160	180
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	..
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan.., '98.	71	71½
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	112	115
*International Ocean Tel Co.guar6%	100	3,000,000	......	1½ % Q.	107	110
Mexican Telephone Co	100	2,000,000	......		.59½	.75
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	1½ % Q., Jan., '98.	150	151½
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	73	77
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union/Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	94¼	94½
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Aug 8:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	165	170
Chesapeake & Potomac Telep. Co	100	......	......	....	51	..
Chicago Telephone Co	100	......	......	......	202	..
Central Dist Prtg & Telg.Co.(Pgh.)	100	750,000	750,000	....	..	..
Empire & Bay States Telegraph Co.	...	......	......	....	70	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	71	76½
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	110	115
Providence (R. I.) Teleph. Co	50	....	......	....	85	86½
Southern New Eng. Teleph. Co	100	8,000,000	......	....	119	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 8:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	..	..
General Electric Co............com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	40	40¼
General Electric Co............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	96	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	28	30
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., July, '98.	55	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Aug 8:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,988,000	....	130	131
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1¼ % Oct., '97.	123	124
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	21	23
General Electric Co............com.	100	40,000,000	30,460,000	2 % Q., Aug, 1898.	40	40¼
General Electric Co............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	96	..
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co.....pfd	..	......	......	....	..	..
Pittsburg, Pa.—Aug 8:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	130	140
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Aug 8:						
Edison Electric Light Co	100	2,000,000	......		144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	84¼	84½
*Electric Storage Battery Co....pfd.	100	5,000,000	......	......	41½	42
*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	..
*Penna. Ht., Lt. & Pow. Co.......pfd.	50	5,000,000	......	6 %, Oct., '97.		
Northern Elec. Light & Power Co	10	6,500,000	550,000	$32500 dis. Jan.11'97	13½	14
Southern Elec. Light & Power Co	10	187,500	187,500	....	8	10
Miscellaneous.—Aug 8:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	40	..
Missouri-Edison (St. Louis)....com.	..	......	......	....	15	18
Eddy Electric Mfg. Co	25	......	......	....	....	18
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	115	125
Hartford (Conn.) Lt. & Power Co	25	175,000	......	....	4	7
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	156	166
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	80	87
Rhode Island Elec. Protec. Co	100	......	......	....	110	120
Royal Elec. Co. (Montreal)	..	1,000,000	......	2% Q *	158	160
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1½ % Q	135¾	137
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	100	110

*ex d.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Aug 8:						
American Electric Heating Co	50	10,000,000	....	....	.05	.07
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	35	37
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—Aug 8:						
Consolidated Electric Storage Co	..	......	....	....	18	20
Edison European	..	......	....	....	1	3
Safety Car Heating & Lighting Co	100	......	....	....	..	98½
Worthington Pump Co..........com.	100	5,500,000	5,500,000	....	80	83
Worthington Pump Co.............pfd	100	2,000,000	2,000,000	7 %	90	92
Philadelphia, Pa.—Aug 8:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....		
Electro Pneumatic Trans. Co	10	1,500,000	......	....		
United Gas Improvement Co...scrip.	50	10,000,000	......	....	74½	
Welsbach Commercial Co.......com.	100	3,500,000	......	....	18	20
Welsbach Commercial Co.......pfd.	100	500,000	......	....	73	75
Welsbach Light Co	5	525,100	......	2 % Q	52	58
Welsbach Light Co., Canada	5	500,000	......	....	1½	1¾
Pittsburg, Pa.—Aug 8:						
Carborundum Mfg. Co	100	200,000	200,000			
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	109	110
Miscellaneous.—Aug 8:						
*Barney & Smith Car Co........com.	100	......	1,000,000	....	..	15
*Barney & Smith Car Co ....pfd.	100	......	2,500,000	2 %	..	65
Billings & Spencer Co	25	......	....	....	30	37
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	30	35
Johns-Pratt Co	100	......	....	....	..	97
*Pratt & Whitney Co.............com.	100	......	....	....	..	10
*Pratt & Whitney Co...............pfd	100	......	....	....	45	51
Stillwell-Bierce Co...............com.	..	......	....	....	96	93
Stillwell-Bierce Co..................pfd.	..	......	....	2 % Sept. 1, '97.	107	109
Shults Belting Co	100	500,000	....	....	60	80
St. Charles Car Co	...	....	—	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Aug 8, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..........1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR.1st mtg. 6s	850,000	850,000	1919	M. & N.	*118½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..........1st 5s	....	....	......	......	*105	105½

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Aug 8, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113½	114
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	113½	114
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103⅛	104
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116⅛
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	102¼	102¾
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co.........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	116	117
City & Suburban Ry......1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	114	......
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	....
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	118	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st.mtg.bds.

Boston, Mass.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	101½	105
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104	105
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry .Co.

Chicago Ill.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¼	102¼
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T...........4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	103½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	54	54¾
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	104	104¼
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	104½	....
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	99¼	99⅞
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	94
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Aug 8, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov.St. Ry.1st Con.mtg. g.5s	3,000,000	2,500,000	1922	J. & J.	102	102½
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	108
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons.mtg.5s	531,000	531,000	1906	M. & S.	107¼	108½
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‖So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	102	102½
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry.Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103½	105
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
aEast Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102	105
Ft. Wayne (Ind.) Elec. Ry.1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	106	......
New Haven (Edgewood Div.)1st mtg.5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 6s.	100,000	94,000	1909	M. & S.	102	......

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	101	....
Crescent City RR............1st mtg. 6s.	......	50,000	1899	M. & N.	100¼	.....
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	76	79
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	105	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100¼	101¼
N. Orleans & Carrollton RR.2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	110	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	101½	....
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	104¼	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn).1st gen. mtg.5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	108	109
‡Bro'dway & 7th Ave.1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	110	112
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface..... ......2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	103¼
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	112	....
¶Brooklyn, Bath & W.E. RR.Gen.mtg.5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR.......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	103	....
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109	109¾
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	104	......
Bleecker St.& Fult'n Fer'y RR.1st mtg.7s	700,000	700,000	1900	......	101	104
Cent P'k, N. & E. R. RR.1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	111½
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118½	......
Coney Island & Brooklyn RR.1st mtg.5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen.mtg.g.5s	1,000,000	930,000	1932	J. & D.	115¾	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100	*103
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	113	116
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	95
Lex. Ave. & Pav. Ferry RR.1st mtg. g.5s.	5,000,000	5,000,000	1993	M. & S.	121	122
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	114	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	107	109
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	107	......
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	121	122½
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	103	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	112½	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112½

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.....................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—Aug 8, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry.....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry.....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	102	103
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co..................Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	.....
West End Passenger Ry..........1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	....	......
Central Traction Co...............1st mtg. 5s.	375,000	375,000	1930	J. & J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co..........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108	109
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	105½	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	105	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	....	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	105	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co.....................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation—Aug 8, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	100½	101½
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	101½	102½
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1918	J. & J.	111	112½

*With interest. *Unlisted.

*With interes

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Aug 8. 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	$50,000	$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co....................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	106⅛	107½
Missouri RR. Co.....................................	1,000,000	700,000	1916	M. & S.	106	107
‡Mound City RR. Co.............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	103
People's RR. Co....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co.....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co..............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry..................Income 5s.	300,000	300,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry.......1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110½	111¾
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co...........Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co. ‡Controlled by Union Depot RR. Co. ‖Controlled by Lindell RR. Co. ¶$200,000 in escrow to retire 1st & 2d mtg. §$600,000 in escrow. ††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation— July, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114¾	....
†Ferries & Cliff House Ry....1st mtg. 6s.	650,000	650,000	1914	M. & S.	113½	....
Geary St., Park & Ocean RR..1st mtg. 5s.	1,000,000	671,000	1921	A. & O.	92½	97½
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1913	J. & J.	126	....
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	.....
†Omnibus Cable Co..............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	124½	.....
†Park & Cliff House RR........1st mtg. 6s.	350,000	350,000	1912	J. & J.	109	.....
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	88½	110
†Powell St. Ry........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118½	120
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109¼	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Aug 8, 1898.						
Belt Ry. Co......................C • mtg 5s.	500,000	450,000	1920	J. & J.	33	....
Columbia Ry................ .... mtg. 6s.	500,000	500,000	1914	A. & O.	118	122
Eckington & Soldiers' Hom.. mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	118	119½
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Aug 8, 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	111	112½
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	108½	110
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	101	102
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	105¼	105½
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	101½
Denver City Cable Ry...........1st mtg. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	79
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	113	114½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	90	93
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	8,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N.J.)...2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	96	....
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry........................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and d mtg. bds. ‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co. ¶$760,000 in escrow to retire bonds of O. C. St. RR. Co. ‖$87,000 in treasury. §$960,000 res'ved to redeem prior liens. ††$620,000 in escrow.					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Aug 8, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	96	....
Pittsburg, Pa.						
Date of Quotation—Aug 8, 1898						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light...........4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	......	......
Miscellaneous.—(Aug 8, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	110	....
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117½	......
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	......	......	....	......
Edison Illg. Co. (St. Louis)................	4,000,000	......	1928	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	......
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000					

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Aug 8 1898.						
American Bell Telephone...................7s.			1898	F. & A.	100	....
Northwestern Telegraph Co...............7s.	....	......	......	......	....	.....
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	....	......	......	......	106	.....
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Aug 8, 1898.						
American Electric Heating.............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co......................	....	....	....	......	......	25
Barney & Smith Car Co...................†6s	....	....	1942	J. & J.	97	100
Carborundum Mfg. Co.........................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co.........................	75,000	....	....	......	....	....
*Unlisted †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11⅜@11½c.; Lake, 11½c.; casting, 11¼@11½c.

The report of City Auditor Boyden makes the gross earnings of the Cincinnati Street Railway for the year 1897 $2,486,666.98.

The West Chicago Street Railway Company has declared a dividend of 1½ per cent., payable August 15 to stockholders of record August 5.

It is proposed to establish a $150,000 telephone company to operate in Worcester, Mass., in competition with the Bell Company. The stock will be offered for public subscription at $25 per share.

A company has been formed at Berlin, Ger., under the title of the Electric Power Company of Santiago de Chile, with a capital of 24,000,000 marks. Extensive electrical undertakings in Chile are soon to be started by the company.

Trains of the Lexington Avenue line of the Brooklyn (N. Y.) Elevated Railroad have begun running over the Brooklyn Bridge permanently. They are to run on three-minute headway, and are operated by motor cars, with the third rail system, from the Bridge street station, Brooklyn.

A Boston dispatch states that the directors of the Electrolytic Marine Salts Company are still hopeful that the stockholders will get about 30 per cent. of the par value of the stock if litigation in the courts does not follow and a receiver is appointed. If such a thing takes place, the directors argue that about all the money in their possession will be used up in legal expenses, and that the stockholders would scarcely have anything left.

The United States Commissioner to the Paris Exposition has opened offices in the Equitable Building, New York. The office in New York will be in charge of an Assistant Commissioner-General and will cover the Eastern States, while a similar office in Chicago will cover the West. Chief Commissioner Ferdinand W. Peck will go next month to Paris, where he hopes to get more space for this country. It will probably be suggested to American exhibitors that they combine their exhibits, as otherwise many would have to go unrepresented.

Papers for the merging of the Nassau Electric Railway with the Kings County Electric Railway Company, the Coney Island, Fort Hamilton & Brooklyn Railroad and the Union Railroad Company were filed in Brooklyn, N. Y., on the 3d inst. The capital stock of the Nassau Company is increased from $6,000,000 to $15,000,000, divided into $6,500,000 cumulative 4 per cent. preferred and $8,500,000 common stock. The liabilities of the Nassau Company are stated as $5,500,000 in 5 per cent. mortgage bonds, a floating indebtedness of $1,811,200 and $480,000 permanent annual rental charges.

The Governor and Attorney-General of New Jersey on the 2d inst. accepted a check for $11,500 from the Electro Pneumatic Company, whose charter was declared void by Governor Griggs last year for non-payment of franchise taxes amounting to $18,000. The company has been reinstated as a New Jersey corporation under authority given to the Governor and Attorney-General by the last Legislature. It was incorporated in 1886 to make and use pneumatic and electrical inventions for the distribution of packages.

The space regulation in the operation of trolley cars on the Brooklyn Bridge has materially reduced the number of cars that can be operated during rush hours and has therefore diminished the receipts of the trolley companies. A number of plans to overcome the difficulty are being considered. Engineers who have closely examined the bridge structure say there is no danger to be feared from any load that traffic on it is likely to cause. Bridge Commissioner Shea, however, has invited Washington A. Roebling to come to New York and make an examination of the bridge, his report to be furnished to the general public as speedily as possible, in order that they may have authoritative information regarding the present condition of the structure.

W. Huntington, president of the American Railway Electric Light Company, has demanded of the Philadelphia "News Bureau" from whom it secured its information regarding an article it published lately, in which it was stated that a receivership for the company was not improbable in order to effect a reorganization. The letter continues: "You must be aware of the fact that the publication of such a notice, which in its effect depreciates the value of the holdings of a large number of stockholders and which notice is unwarranted by facts and unjustified in the nature of its insinuations, is, according to law, an indictable offence." Mr. Huntington says that unless the information sought is given he will proceed against the "News Bureau."

The Cleveland Electric Illuminating Company's first mortgage 5 per cent. gold bonds are recommended by Spencer Trask & Co. as being particularly desirable for permanent investment. The bonds are in coupon form, $1,000 each, with privilege of registration. They are redeemable on and after April 1, 1910, at 110 and accrued interest. The amount outstanding is $1,200,000. These bonds are secured by a first mortgage on all the property, rights and franchises of the Cleveland Electric Illuminating Company, which is the only electric lighting company in the city of Cleveland, O.

According to the "American Manufacturer," electricity is furnished near Niagara Falls for $18 per horse-power per year for continuous service. Allowing a loss in the application of 25 per cent. in the case of electricity and 50 per cent. in the case of steam, due to the greater use of belting and shafting, the mill using 1,000 horse-power under steam conditions would need only 750 electrical horse-power. This, at $18, amounts to only $13,500, against $60,000 for the steam plant, or a saving of $46,500 per year. This sum represents a dividend of nearly 10 per cent. on a capital of $500,000.

The Chicago "News" says: "The Commonwealth Electric Company will issue $2,500,000 5 per cent. 45-year bonds. A syndicate is forming which will take $2,000,000 (the amount that will be put out at once) of the security. There will also be reserved $150,000 to take up a like amount of underlying bonds issued by the various corporations which were absorbed by the Commonwealth, and the remaining $350,000 of bonds will be issuable for extensions. The mortgage will provide that after this $2,500,000 of bonds are issued still other bonds may be issued to cover 75 per cent. of the actual cost of further extensions and improvements."

The industrial and commercial development of electricity on a large scale dates practically from the International Electric Exhibition held in Philadelphia in 1884. At that time the total investment in electrical applications in the United States, exclusive of telegraphy and telephony, was less than $1,000,000. The capitalization in the electrical applications in this country at the present time is estimated at about $1,900,000,000. The electric lighting plants in the United States represent a money investment of $600,000,000. Electric railways have a mileage of 14,000, with a nominal capitalization of about $1,000,000,000, and employ 175,000 men. The capitalization of the telephone service is about $100,000,000, and about 1,000,000 telephones are in daily use.

The Boston "News Bureau" says: "The proposed reorganization of the American Electric Heating Corporation whereby the $10,000,000 capital was to be scaled to $1,000,000 will probably not be attempted this year. The bondholders of the company are also the largest stockholders and they will probably be content to go without their interest and effect no radical reorganization at present, in the hope of better things to come. The large owners of this company believe that there are great possibilities in the electric heating field, but they realize that electric heating is in its infancy, and it is not anticipated that the use of electric heating apparatus will come into general use until lower rates are obtainable for electricity."

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CONTENTS.

EDITORIAL NOTES.

The General Electric Company and its Impaired Capital.

At the special meeting of the stockholders of the General Electric Company at Schenectady on August 10, for the purpose of reducing its capital stock, over 95 per cent. of the shares of the stock was represented. Such a large number of proxies were handed in however that the whole of the afternoon was consumed in checking them off. It was 6 o'clock before the credential committee, which consisted of Messrs. W. Lowell Putnam, R. Treat Paine and M. F. Westover, was ready to report, and it was therefore decided to defer voting on the question until August 17.

Mr. Putnam presented a minority report, objecting on various grounds to some of the proxies. The majority report on the other hand approved of the authority of all the proxies presented, both reports being finally ordered filed.

A question was raised as to the legality of the action taken, the counsel of the company giving it as his opinion that no injunction would be granted upon the bill of complaint by Mr. T. L. Livermore, and that, even granting action should be taken, it would merely place the stockholders back to their original rating. Mr. Livermore claims that the proposed reduction will be injurious to the interests of the minority holding preferred stock, and also that the common stock is not properly represented, while those in favor of the plan assert that with the capital reduced the stockholders will be able to draw dividends, and that furthermore it would be of great benefit to the company.

That some action looking toward a reorganization was necessary has long been apparent to all those in any way familiar with the financial condition of the General Electric Company, especially during the last few years. According to its Sixth Annual Report the company's net earnings during last year amounted to $1,231,852.37, while it owes its preferred stockholders $1,488,200 unpaid dividends that have been accumulating since July, 1893. In other words, it would take more than a year's net earnings to settle with its preferred stockholders, to say nothing of its common stock, on which likewise no dividends have been paid for the last five years. All the accumulated unpaid dividends on the preferred should by right have been added to the liabilities of the General Electric Company and considered as such, but, as we have frequently pointed out, as liabilities they have been persistently ignored.

This proposed reduction of preferred stock, and likewise of future dividends, by a joint vote of the preferred and common stockholders, would seem in our opinion to be a very dangerous precedent, for if such action is allowed to pass what is to prevent a corporation in which, as is usually the case, the common stockholders are in the majority from voting, if it feels so inclined, to reduce the holdings of the preferred stockholder ninety, or for that matter even 100, per cent. and thus get rid of him altogether? This method of remedying capital impairment should have the effect of making purchasers of preferred stock extremely cautious.

If the proposed deal goes through, and the preferred stockholders are paid their accumulated dividends, and the value of patents is reduced by $4,000,000, the next Annual Report of the General Electric Company will cut but a sorry figure.

* * *

Motive Power on Elevated and Suburban Roads.

The question of adopting a suitable motive power on street railways, elevated and suburban roads is an all-important one. The Metropolitan Street Railway Company of New York has just issued some $15,000,000 in bonds for the alleged purpose of equipping its remaining lines with electricity, and there is still much talk of changing the motive power on the elevated roads, although the policy of the Manhattan Elevated people would seem to be that of making haste slowly. In a very interesting article on this subject which recently appeared in the New York *Times*, Mr. H. G. Prout says:

"Whether or not electricity would save anything in cost of operation in this special case is a matter of debate among experts. The steam locomotives now used on the Manhattan Elevated are efficient machines, and, taken all in all, the elevated railroads of New York give the people a service which in the combination of the magnitude of the traffic, the safety with which it is carried, the speed, the regularity, the comfort, and the economy is unparalleled in the history of transportation; it is probable that no other instance can be found in which these elements are combined on such a scale. But, further, the service is possibly the most intense in the world, and an interruption causes inconvenience to thousands of people. But with the steam locomotive each train is a self-contained unit, and an accident to that train does not necessarily interrupt the traffic over the whole line or interrupt it for a considerable time, but with electric working the whole system is on one string. A failure in the power house or in the conductors stops everything. In practice this difficulty is not as serious as it is in theory, but the danger is present, and the prudent engineer is bound to think of it when he decides between steam and electricity."

In the last half of the above paragraph the writer

aptly points out the principal disadvantage attending the use of electricity either on an elevated road or on roads such as the electrically equipped sections of the New York, New Haven & Hartford Railroad. That there would be danger of a suburban road equipped electrically breaking down at some inopportune moment is not to be doubted, and for this reason the equipping of such a road with, for instance, the third-rail system would scarcely seem advisable. Imagine the inconvenience that would be experienced were a suburban road such as the Long Island Railroad to break down on a summer morning as occasionally happens in the case of the Brooklyn Bridge cars. In regard to the equipping of the Manhattan Elevated with electricity, the advantages to be gained by doing away with the existing smoke nuisance and affording increased traffic would in our opinion outweigh the danger of a breakdown occurring, and even in the event of a breakdown there are other means in a city such as New York for speedily reaching one's destination.

* * *

Electricity in Mines. Until recently compressed air or steam was the motive power most generally adopted in mines. During the last few years, however, electricity has been gradually made use of for various mining purposes, first being installed in what are termed non-fiery mines or collieries in which explosive gases do not accumulate. The purposes for which power in most mines is required are haulage, drilling, coal cutting, pumping, hoisting, lighting, signaling and blast firing. The introduction of electric haulage in non-fiery mines offers no serious difficulty and has been adopted in a number of cases, as the cost of haulage by electricity is some thirty per cent. less than with mules. The electric drill, of which there are two distinct types, is also coming more and more into use, especially in coal mining. For the latter class of work, or where soft rock is to be pierced, what is known as the augur-drill is used. This type of drill is mounted upon an iron frame which is held upright by being securely pressed between an overhead beam and the floor by means of a vertical screw at the bottom much resembling in appearance and operation the old form of jackscrew. An electric motor is securely fastened to the frame, a pinion being attached to the armature shaft, which in turn gears in a toothed wheel of larger diameter, through which the augur passes. The necessary current for operating a drill of this description may either be taken directly from the mains or from a generator mounted upon a car. When boring through coal, holes may be drilled at the rate of a foot a minute, which has proven considerably more economical than hand work, in spite of the fact that the whole apparatus has frequently to be taken down and moved to a new spot, entailing considerable time and labor.

The electrical percussion-drill is operated on an entirely different principle from the augur drill, a plunger to which the drill is attached being made to move through the medium of magnets backwards and forwards in a cylinder somewhat similar to that of a locomotive.

Electric coal-cutters are now quite extensively employed in mines in various parts of this country. Their principal advantage would seem to lie in the fact that where such a machine is used the coal can be gotten out with much less breakage and consequent waste. Statistics go to show that a man working with an electric coal-cutting machine can under ordinary circumstances get out one-third more coal than can a man working with a pick. This does not necessarily mean that there is one-third more profit in the use of such a machine than by the hand method, as the cost of the current, repairs and interest on the outlay would have to be deducted; but even allowing liberally for these items the electric coal cutter has proven more economical.

As far as hoisting by electricity is concerned, the constant starting and stopping is not conducive to economy as the motor is essentially a constant-speed machine if high efficiency is required. In spite of this fact, however, in mines that are equipped with electricity electric hoists are used to a limited extent. The firing of blasts is usually accomplished by small portable machines and not as a rule by taking current from the electrical mains.

Great care has to be exercised in installing electrical apparatus in fiery mines, and until comparatively recently the motive power in such mines has been compressed air. All wires, switches and motors have to be arranged in such a manner as to eliminate all possibility of sparking. However, since the introduction of polyphase motors, requiring no commutators or brushes, the problem has been simplified, and by observing proper precaution in running the wires and placing the other apparatus, little danger from explosion due to an electric spark is to be apprehended.

That electricity will gradually supersede other forms of power in mines cannot be doubted. Mr. Rankin Kennedy, who a few years ago thoroughly investigated the advantages and disadvantages of electricity in mines, expressed his opinion in one of the leading English technical papers as follows: "In the non-fiery mines electrical transmission is cheaper in first cost and in maintenance, much easier applied and higher in efficiency than compressed air. In fiery mines it is much more efficient and with induction motors quite as safe, although difference in first cost is not so great."

Under the Searchlight.

Notes and Comments on Various Topics.

More Financial Jugglery.

The Boston *News Bureau* of August 11 says:

It is officially stated that the directors of the Westinghouse Electric & Manufacturing Company have, by authorizing the issue of $3,500,000 fifteen-year 5 per cent. gold debenture certificates and by selling $3,000,000 of such issue, completed a financial transaction of great advantage to the company and its stockholders. The proceeds of the sale of these debentures will retire the outstanding floating and bonded debts of the company and return to its treasury as available assets stocks and bonds in various lighting and power companies yielding an annual income exceeding one-half the interest charges of the debenture certificates.

Where have these bonds been—in hock? The common stock of the Westinghouse Company having lately been worked up some five or six points, it would seem as though Mr. Westinghouse contemplated following in the footsteps of Mr. Coffin. It would however be shockingly rough on the creditors of the Westinghouse Company were the preferred stock of that corporation reduced by vote of the common shareholders.

* * *

"LIGHTNING" of London is responsible for the following:

A few days ago I was riding on an electric tramcar, and, contrary to all regulations, fell into conversation with the man at the wheel. After hearing to my astonishment that he had learned the profession of "motorman" in thirty minutes, I mildly suggested that he should teach me. He evidently thought this would be too much for him, but after a little polite persuasion, and the signature of an affidavit that I considered myself to be a sober and devout individual of sound mind and well disposed towards the commonweal, he put me on to the handles. Now driving a tramcar is like riding a bicycle, quite easy when you are used to it but at first you are apt to get mixed. All went smoothly for a few seconds; we were bowling down hill with no current on and there was a sharp curve in front. "Slow down and ring the bell," said my tutor, so I put on the brake. "Where's the bell?" says I. "Down below," says he. Looking down I observed a lever sticking out, something like the knee swell of an organ, so I knocked it over and the bell rang; then away we went again, my tutor instructing me in real Thames steamboat fashion—"Ease her," "Stop her," "Start her," "Turn astarn," etc. Then, as we overhaul a perambulator, "Ring bell," says he, so down I come on the knee swell. "That's the sand box," says he; but the baby saw the tram and screamed, and the nurse cleared out, kissing her hand to the conductor—so we were all saved. My tutor thought I did pretty well for a beginner, so I handed him the reins and lit a cigar. On the whole, I conclude he was better pleased with my smoking than my driving; of course something must be allowed for experience.

* * *

BY the terms of the protocol signed by the representatives of the United States and Spain at Washington on the 12th inst., Spain relinquishes all claim of sovereignty over and title to Cuba; Porto Rico and other Spanish islands in the West Indies, and an island in the Ladrones, to be selected, are ceded to the United States, and the United States will hold and occupy the bay and harbor of Manila pending the conclusion of a treaty of peace which shall determine the control, disposition and government of the Philippines. These are the results of the war between Spain and the United States in the year of our Lord 1898, of which the following is a skeleton chronological record:

Feb. 15—The battleship Maine blown up in Havana harbor.
May 1—Dewey destroys Spanish fleet at Manila.
May 19—Cervera's fleet reaches Santiago.
June 3—Sinking of the Merrimac.
June 22—Shafter's army lands at Baiquiri.
June 26 to July 4—A series of brilliant engagements on the outskirts of Santiago including the capture of El Caney and storming the heights of San Juan.
July 3—Cervera's fleet destroyed.
July 14—Santiago surrenders.
July 26—Miles lands at Guanica.
July 29—Ponce surrenders.
Aug. 11—Spain accepts our peace terms.

To this may be added the capture of Manila by Dewey on August 13.

* * *

THE Boston *News Bureau* is responsible for the following:

One prominently identified with electrical matters says: "I do not believe that many of the manufacturers of electrical machinery, such as the General Electric, Westinghouse and Walker companies, are making money to-day notwithstanding the fact that they are all rushed with orders. The reason for this is that they are obliged to do so much experimental work that a goodly percentage of profits goes into the scrap heap. Many contracts are taken at prices which show a loss, principally for the reason that the company's experts find it impossible to give reliable estimates on machinery which the companies have never before manufactured. I believe that a general electrical consolidation will have to take place before there will be any large profits in the business, for with three or four competing companies in the field, all with large salary lists, prices are bound to be placed as low as to prove unprofitable to the companies securing the contracts."

There is not the slightest doubt but what some of the larger electrical manufacturing concerns, notably the General Electric Company, are in the habit of taking contracts at an extremely low figure, with little or no profit, but we do not think that this is due to any of the reasons given above. There are other reasons for this, and we have frequently pointed them out.

* * *

WE reproduce the following from the New York *World*, and sincerely trust none of our readers will laugh themselves ill:

He—Have you heard the latest?
She—What is it?
He—Never look an auto-car in the motor.

* * *

THE American officers in Santiago are laughing over a joke which some of the Spanish officers told on themselves. At the Casino Espanol they had a graphophone and during the siege the favorite piece of music which came from the instrument was one of whose name and origin they were ignorant. It was not until after the capitulation of the city that they learned from American bands that their favorite tune was "The Star Spangled Banner."

* * *

COMMISSIONER OF INTERNAL REVENUE SCOTT has announced that the Internal Revenue office holds that

an electric belt, manufactured and recommended as a remedy for diseases of the human body, is a mechanical appliance or device, and although used remedially or medicinally, cannot properly be included in the terms of Schedule B of the War Revenue Act taxing medicinal preparations. This decision would certainly seem just, as the so-called electric belt is unquestionably purely a mechanical appliance and should not be taxed as a remedy any more than the faith cure.

* * *

The barbed-wire fences surrounding Santiago, and which have proven a hindrance and nuisance to our hard-worked soldiers, have, it seems, after all, their advantages. Not long ago one of the wires of such a fence was sufficiently insulated to allow of telegraphic messages being sent from one army corps to another a distance of five miles. Thus the Spaniards unwittingly saved the enemy's signal corps the trouble of laying a wire through a rugged country.

* * *

Probably the first practical application of wireless telegraphy took place during the Royal Alfred Yacht Club Regatta held recently in English waters. Wireless messages describing the race were sent over distances varying from five to ten miles, and were published in successive editions of the Dublin *Evening Mail*. Signor Marconi was himself the operator, transmitting the messages from a steam tug, "The Flying Huntress." The instruments are said to have worked splendidly and not a single message had to be repeated.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

"FOOLS ARE MY THEME."

It is a creed with some that the fools far outnumber the wise in this world. We have never ourselves advanced this doctrine, but there are times when we are impelled to ask if it does not contain an element of truth. Otherwise how can we explain the present situation of the Electrolytic Marine Salts Company? To be quite frank, we had not supposed the fools to be anywhere near so plentiful as the experience of this company has demonstrated; and that perhaps is saying a good deal. When the Reverend Jernegan and his associates began to send out their circulars inviting the public to subscribe to their little scheme to extract gold from sea water, we expected they would "rake in" some money before they fled the country, but we did not anticipate that they would "go through" so many persons of presumed business intelligence. The masses, being without financial training, are peculiarly liable to be taken in by every trickster that comes along. But when a man has been in business thirty or forty years, and has displayed enough judgment to acquire a competency, you have a right to expect that he will not try to extract sunshine from cucumbers or gold from sea water. The fact that so many persons of large means were caught by such a palpable fraud as the Electrolytic Marine Salts Company is calculated to make cynics the world over laugh themselves hoarse.

We suspect it will be necessary to go back nearly two hundred years to find an enterprise on its face so delightfully absurd as the Electrolytic Marine Salts Company. Many comments are now being passed on the Reverend Jernegan's shrewdness, but we are inclined to believe that were he not by nature a most consummate ass he would never have attempted such a scheme. It is incredible that any one in his senses should have believed that there was the ghost of a possibility of "working the racket." And yet it worked beautifully, and perhaps after all its promoter was endowed with a knowledge of human nature so profound as to be almost preternatural. He certainly sized-up his fellow-creatures much more accurately than we should have done, and we do not mind confessing that this is an acknowledgment we do not consider due everyone.

Well, the gentlemen who have put their $10,000 apiece into the Electrolytic Marine Salts Company—to say nothing of the humbler contributors—may now consider that their money has "suffered a sea change into something rich and strange." They have our sympathy, but we can, nevertheless, not help drawing the comforting reflection that life will never become "flat, stale and unprofitable" (though we are not so sure in the latter particular) while such delightful rogues as Jernegan abound.

We always feel inclined after an episode like this to give some good advice. Our first point is, beware of enterprises that are floated on the names of clergymen. We regard the clerical profession the highest among men, but we have not much regard for clergymen who descend from that lofty estate to float joint stock companies. And if we may be quite frank, we may say that we regard as a fool any man who views the situation differently. In the second place, scrutinize sharply every kind of a stock that is offered you at fifty cents a share. A small par value does not always indicate bad faith or poor prospects, but when you consider that the proportion of companies so capitalized that go to the wall is overwhelmingly large, it is just as well to look before you leap. In the third place, use a little of the reason with which you have been endowed by nature, and reject all schemes which on their face are absurd. But it may be said that the Electrolytic Marine Salts Company was not of such. Well, we have no reply to make, except perhaps to say that the person so holding has our entire sympathy. One is not to be blamed for congenital defects.—*U. S. Investor.*

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.

The Annual Convention of the above Association was held at Elmira, N. Y., on the 10th and 11th inst. About sixty delegates were in attendance and many of them were accompanied by their wives and daughters. The acting mayor of the city, Alderman A. J. Watson, welcomed the visitors to the city in a brief but hearty speech, which was appropriately responded to by Clarence E. Stump. President William Y. Ellet of the Association then delivered an address in which he said:

"Our work is not a mere trade. We do not hold a job. By faithful study and by practical demonstration we are fast raising our business into the grade of a profession. It is now taught in the progressive colleges and a start may be made towards acquiring its mastery while still under pupilage in the schools. It follows that there is something of permanency in the position of municipal electrician when once it has been attained; and this is wise, for the expert has not only to know his apparatus, but must also know how and where every portion of it is located throughout the city which he guards; and this is not the least of his requirements. Other men will honor us as electricians if we but honor the profession that we pursue. The progress of electrical science is the wonder of this wonderful age. The men who keep abreast of its development are in the forefront of progress; the world is looking to electrical experts for its freshest triumphs, and they are invading as well as transforming every field of human industry. If we bear a modest part in this great advance it is still an important one and is never at a standstill. The discussions of this meeting will amply demonstrate this proposition. The able men who adorn the roll of our membership will find a hearing far beyond the walls of this chamber, and in the secular as well as in the technical press."

The papers read were as follows:

"Electrolysis; the Best Means of Prevention," by Capt. Wm. Brophy of Boston, Mass.

"Maintenance of Central Office, embracing the Storage Battery," by Morris W. Mead of Pittsburg, Pa.

"Aerial Construction," by W. H. Thompson of Richmond, Va.

"The Difficulties a Superintendent Has to Contend With, and the Best Way to Avoid Them," by F. P. Foster of Corning, N. Y.

"What the Association Has Accomplished Since Organization," by J. W. Aydon of Wilmington, Del.

Wilmington, Del., was selected for the next Annual Convention. The officers elected will be found in our "Telephone and Telegraph" department. The name of the Association there given, however, is "The National Fire & Police Telegraph Superintendents and City Electricians' Association."

The new president, J. W. Aydon, was born in Wilmington in 1850. He learned telegraphy in the office of the Western Union Telegraph Company in Philadelphia, and entered the service of the Philadelphia, Wilmington & Baltimore Railroad Company in May, 1868, as operator at Clayton, Del.; in 1871 was appointed train dispatcher in the Philadelphia office. He is now completing his thirtieth year of continuous service for that company, many years of which have been spent in the Wilmington office. Mr. Aydon has always taken an active part and shown a deep interest in public affairs, and in 1883 he was elected superintendent of the police and fire alarm systems of Wilmington, which position, with a slight intermission, he has held since.

M. WITZ ON THE DIESEL MOTOR.

Writing in the *Revue Général des Sciences*, that well-known authority on the gas engine, M. Aimé Witz, criticizes the Diesel motor and explains it. He shows first how the Carnot cycle, which gives a maximum efficiency, commences with an isothermal compression, continues the compression adiabatically, commences the expansion isothermally and continues it to the initial point adiabatically. But to secure an ignition temperature from the adiabatic portion of the compression it would be necessary to use a pressure which would be inadmissibly high in practice. M. Diesel therefore abandoned the double compression and replaced it by a single adiabatic compression whereby he attains the temperature of ignition. He then introduces fuel and allows expansion to proceed along an isothermal until the fuel entry being cut off the remainder of the expansion takes place adiabatically. The effect is not equal to that of the Carnot cycle; it is less though still high. For a pressure of 250 atmospheres the efficiency is 0.730. Good as this is, the ordinary gas engine would give an equal return for equal compression and possesses all the advantages in elasticity and power, complete combustion and smartness of running that is possessed by the Diesel motor. In a word, the Diesel motor has no theoretic pre-eminence over the ordinary combustion motors.

Though M. Diesel contemplates air compression to 250 atmospheres and the employment of solid fuel pulverized, in reality the engine set to work in summer, 1897, had only 35 atmospheres of compression and used petroleum in one cylinder in place of the three cylinders contemplated in the compound ideal engine. The theoretic cycle is cut short at each end of the diagram, and the cycle is as follows: (1) Indraft of air during the descent of the piston; (2) compression of this air on the up stroke; (3) introduction of combustible gradually, and expansion along the double curve, first isothermally, and then, after cut-off, adiabatically; (4) exhaust.

There is a small air compressing pump which delivers to a reservoir; distribution is effected by

valves actuated by cams. The valves are in no sense peculiar, but are very carefully made for the high pressures employed of 35 atmospheres, M. Diesel having however renounced his ideas as to 250 atmospheres. Injection of combustible is regulated as to its duration of injection by means of a centrifugal governor. Though Diesel has not been able to realize his expectations, his motor may be considered worthy of attention. The substitution of a practical cyle of maximum efficiency for the Carnot cycle has vanished, and the actual motor is less original than the idea which gave it birth, but the cycle realized is sufficiently interesting to constitute a distinct event in the history of the oil motor industry. The existing motor, as made, has a power of about 20 HP., a cylinder of 0m.250 in diameter and 0m.40 stroke. It makes about 160 revolutions per minute and consumes 230 grammes of oil per HP. hour effective (? brake) at full power, and 278 grammes at half power, a remarkable result comparable with the Priestman 8 HP. engine at the Plymouth trials, which consumed 385 grammes; the Niel motor at Meaux of 6 HP., which used 307 grammes, and the Grob motor of 7 HP., which used 271 grammes. A 4 HP. motor of one Pétréano was claimed to have only used 250 grammes. Thus the Diesel motor is allowed by M. Witz to be the first in economy. The calorific power of petroleum being 11.015 calories, the horse-power hour requires 2.621 calories. The efficiency is thus 24.2 per cent. as against the best at Meaux of 21.2 per cent. M. Witz expects that Diesel may even improve on these results, and recommends inventors to follow his example and strive after higher compression, a fact pointed out long enough since.—*Electrical Review, London.*

FALK CAST-WELDED RAIL JOINTS AT NORWICH AND COVENTRY.

As announced by us a short time ago, the Falk system of cast-welding has been adopted for the Norwich and Coventry electric tramways. The essential difference between tramway and railway track is that the rails for a tramway when once laid are covered in up to the tread of the rail by paving of some sort, while railway rails are exposed. When tramway track is once laid, unless special devices are adopted, it is impossible to get at the fishplates, and the bolts become loose. It has been the experience on all the tramways in this country on which mechanical power has been used, that after a very few years the joints begin to give trouble. When heavy motor cars pass over a joint, unless the joint is absolutely solid, there is a tendency on the part of the rails to separate while the wheel is passing from one rail on to the other. This causes what is known as the "hammer-blow," which is both injurious to the motors on the car and bad for the track. It causes the head of the rail to wear down at joints, thus increasing the tendency to hammer. The best possible track would be a continuous one, i. e., without any joints whatsoever. For many years past, but especially since electric traction was introduced, means have been sought whereby this could be practically attained. The first idea naturally was to electrically weld the rails, and the Johnson Company of the United States spent a great deal of time and money in trying to perfect a system of electrically welding the track. As far as the operation itself went, it was perfectly successful. There was only one drawback, namely, the cost of the plant required to do the work, and the necessity of having highly skilled labor. The price of the joint was therefore excessive.

The Falk Manufacturing Company finally succeeded in practically solving this problem, and since 1894 a very large mileage of track in the United States has been laid on their system, and excellent results have been obtained. We have examined many miles of such track, and have found this method of jointing give very excellent results in practice. There is still in this country a great prejudice against the continuous rail. It is thought by some that if a continuous track is laid, and the paving on the length of road removed, the track will buckle or "hog," but experience has proved that this is not the case. In tramway work variations of temperature do not affect the rails as much as one might expect, owing to their being entirely covered in and supported by pavement. It is easy to ascertain the strain on the rails due to the variations of temperature. Assuming a coefficient of expansion for steel of 0.0000065, and multiplying this by 75, which is a liberal figure for the number of degrees of maximum deviation from the temperature at which the welding is done, we get 0.000487, which is that part of its length which a rail would vary when exposed to a variation of 75 degrees. A steel bar will extend 0.00003 of its length when subjected to a tensile stress of 1,000 lb. per square inch. Dividing the estimated expansion by this figure, we get for the strain 16,200 lb. per square inch, as that due to 75 degrees if no expansion is permitted. As 40,000 lb. per square inch is a safe value for the elastic limit of steel, it can readily be seen that the elastic limit is not reached.

Wherever joints have broken, in no case have they pulled apart more than 2 in. This would seem to show that the pull which broke the joint was not a cumulative effort extending all along the line, but merely the result of a local strain extending but a short distance on either side of the joint.

The Falk system is now being introduced into this country for the first time by Mr. Robert W. Blackwell, at Coventry and at Norwich, where some 5,000 joints are now being cast-welded. The system roughly consists in casting a cast-iron sleeve round the sides and bottom of the rail joints, the rail ends being first placed firmly together. In cases where they do not absolutely touch, thin plates of steel are driven in between the heads of the rails before casting. Before fixing the molds, which are of cast iron, the sides and bottom of the rail are cleaned, and this is generally done with an emery wheel or a sand blast. The cast iron used is of a special mixture found to give the best results, and it is run at a greater heat than is used in making ordinary castings. The cast iron running into the iron molds chills rapidly on the outside surface, thus causing very great pressure to be exerted on the metal which is still in its molten state in contact with the web and foot of the rail. As the metal is poured in from one side and comes in contact with the web or thinnest part of the rail at its greatest heat, this part of the rail is brought to a white heat, and owing to the pressure exerted on the molten cast iron, this is practically forced into the interstices of the steel, thus not only making a thoroughly good mechanical joint, but also ensuring a good electrical bond. The section of the cast-iron joint is so designed as to have at least the same tensile strength as that possessed by the rail. The cast-welded joints used are generally about 14 in. long, and the weight of cast iron varies in accordance with the weight of the rail from 70 lb. to 140 lb. per joint.

The cast iron must necessarily be melted close to where the work is being done, and for this purpose a portable cupola on wheels is necessary. The welding plant used at Coventry consists of a small cupola with the necessary fan, steam turbine and boiler fitted on to a truck to be drawn by horses. In the plant used at Norwich gearing is fixed to the wheels, so that the steam engine which drives the fan is also utilized to propel the car.

In answer to the various *a priori* objections which have been raised against the principle of cast-welding, it may be stated, as one example among many, that in 10 miles of track which were cast-welded at St. Louis in the early part of 1894 and over which there has been a very heavy traffic, the joints to-day are in as good condition as when they were first made, and so perfect that it is practically impossible to detect them. At the present moment there are some 200,000 cast joints in the United States, while a large amount of cast-welding has been done in France and Germany.—*Electrician, London.*

Wind as a Motive Power.

The well-known Danish scientist and inventor, Prof. La Cour, has given the question of a more rational utilization of the wind's power a most thorough and careful attention for a series of years, and has carried on a number of State-aided experiments and tests in this connection. In an interesting lecture before a Copenhagen scientific society, Prof. La Cour recently communicated some of the results he had already obtained. He first touched upon a few historical points, stating that the first epoch-making technical essay had emanated from the Alexandrine mathematician, Hero, who lived some 2,000 years ago. The matter was allowed to rest for 1,500 years, when a new move was made in the Orient and by the Mohamedans carried to Europe, where it grew and increased until it, by the discovery of the application of steam, received an immense impetus. But Hero's essay had given the first impulse; it was widely translated and commented upon. The utilization of wind-power became more general, and the engineers of that period gave the bulk of their attention to the construction of wind and water mills. With regard to the most practical construction of a wind mill, says the *Engineering* (London), Prof. La Cour pointed out the fallacy of the opinion that the greatest effect was obtained by horizontally-moving wings. He touched upon he various manners in which the problem of turning the mill according to the wind had been solved, and then dealt with the construction of the wings. The great mathematicians of the last century had given much attention to this question, but all their careful calculations had not led to any real results. Their physical suppositions were erroneous, because they held that the effect upon the mill exclusively depended upon the pressure of the wind when it struck the wings.

The question of the effect of the wind's pressure upon a flat surface is a complicated one, but it has in any case been demonstrated that the suction on the leeside is a very important factor. Prof. La Cour had at his experiments measured the effect an artificial—and consequently even—wind had upon different models at different speeds, and these experiments bore out the correctness of some of the ordinarily accepted rules in the construction of windmills, for instance, as regards the number of wings. A mill with 16 wings has only $1\frac{1}{3}$ times as much power as one with four. In measuring the percentage of the power of the wind striking the wings which was absorbed or utilized by the latter he arrived at the, at first sight, somewhat startling figure of 143.7 per cent. This unlooked-for result was owing to the above-mentioned suction on the lee side of the wind passing between the wings. That the wings should not be plane, but have a bent or a concave shape, was an old-established truism, and the shape of the wings has in reality much influence upon the suction which is more especially caused by the wind which just passes the edges of the wing.

In measuring the percentage of the wind-power utilized it was, consequently, also taken into account the wind passing between the wings, and, instead of 143.7 per cent., the figure was 21 per cent. The absolutely best shape for wings has, however, not yet been ascertained. The most important practical point in connection with windmills is the solution of the problem how best to neutralize the inconveniences caused by the irregularity of the wind. Prof. La Cour has for this purpose constructed an original regulator, called the kratostate, by means of which a windmill can very well be used for working a dynamo.

THE USE OF ACCUMULATORS IN CONNECTION WITH LIGHTING AND TRACTION SYSTEMS.*

BY JOHN H. RIDER,

Borough Electrical Engineer, Plymouth, Eng.

Accumulators have always been an essential part of the equipment of a continuous current lighting station and their value is becoming more recognized every day in alternating current and power stations. In order, therefore, that the opinions and experiences of members may be obtained, this paper is presented, with the hope that it may give rise to a useful discussion.

The efficiency of accumulators $\frac{\text{watts output}}{\text{watts input}}$ will seldom exceed 75 per cent. under ordinary working conditions, and since a steam plant must always be used to charge them, it follows that a given output can generally be obtained more cheaply directly from the steam plant, if it can be run at an economical load, than from accumulators.

But in deciding what is an economical load for any given set of steam plant, the whole of the plant—boilers and piping, as well as engines and dynamos—must be taken into account. By proper subdivision of the dynamo units, it will generally be found possible to keep the running sets at a fairly economical load. But with the boilers and piping it is different. Steam has practically to be kept up for the whole of the 24 hours in as many boilers as will be required at the maximum load, and the whole of the steam piping kept connected ready for use. So that at, say, anything under three-quarters of the maximum load, the steam plant is generally working uneconomically, because of the large "standby" and radiating losses. Therefore it would pay to run one of the dynamos, if necessary, for the sole purpose of charging accumulators when the load on the plant as a whole had dropped to an uneconomical point. Or if a dynamo have to run in order to supply electricity for other purposes, and it can only be run under such conditions at a low load-factor, then it would pay to use its surplus power for charging cells.

The discharge from the cells can, in like manner, be economically used at any time when either a dynamo would otherwise have to run lightly loaded, as for example, when the load on the station was more than x dynamos could do, but considerably under the output of x + 1 dynamos. Or when the gain in efficiency by using the steam plant direct would be more than counterbalanced by the extra number of men required to work it. Or when, by taking a share of the load at the "peak," the total amount of the plant at the station may be reduced.

It may be therefore stated, as a general rule, that it will pay to use accumulators in a station if they can be both charged and discharged at a time when the steam plant or part of the steam plant would otherwise be working at an uneconomical load.

It is practically impossible, in any station, so to arrange matters that all the plant working shall be kept at an economical load for any length of time. The demand is constantly varying, and oftentimes in a most unexpected manner. So that in almost every station a set of accumulators would be of service, the cells being used to level the load on the plant. We all want our "load curve" to be a horizontal straight line, and accumulators will help us to obtain this by filling up the hollows with a charge and by leveling the peaks with a discharge.

Accumulators are of far more value in a station when used in this way than when kept for the purpose of acting as a stand-by in the event of a failure of any of the plant. Of course, when charged they are always available for this, up to the limit of their output, but primarily their use should be to supplement the plant by helping it to work at an economical load.

The prime cost of a battery for a given KW. output (for 5 hours) is roughly the same as for steam dynamos and boilers for the same output. The depreciation need not be more than 5 per cent. per annum, if properly treated and looked after, and this is about the same as for the steam plant.

We will briefly consider the use of accumulators in (1) the continuous current lighting station, (2) the alternating current lighting station, (3) the traction station, and (4) the combined lighting and traction station.

CONTINUOUS CURRENT LIGHTING STATIONS.

Continuous current lighting stations are now almost universally on the multiple-wire system, with either 3 or 5 distributors, and the battery is therefore divided into equal sections, the whole being however in one series. Fig. 1 shows an arrangement which is in use at a number of stations in this country.

It will be noticed that only two of the dynamos are connected with the middle wire. The others (generally of a larger size) are connected directly across the outers. Even though the accumulators may be large enough to take the difference in load between the two sides of the system, when the larger dynamos are running, it is not possible, or at any rate advisable, to connect all the machines directly to the outers, because the two sides of the battery may be discharged unequally, and it is therefore necessary to be able to charge them at different rates.

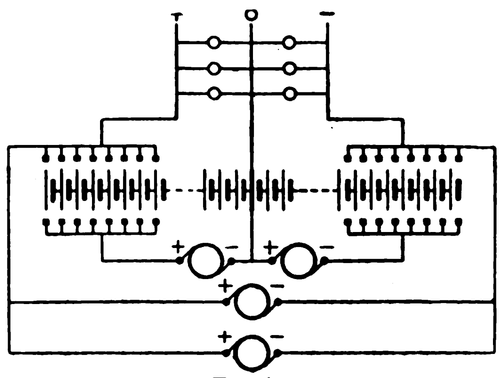

FIG. 1.

The larger machines need only give a voltage equal to that required on the feeders at the highest load. The two smaller ones must be able to give together a voltage at least 25 per cent. higher than this, in order to properly charge the cells. As is well known, the voltage of a cell remains sensibly constant during discharge, but during charge the back EMF. gradually rises, owing to the chemical action and the formation of gases.

One result of this rise of pressure at the terminals of the cells is that the battery must either be entirely cut off from the lighting circuit during charging, or else regulating switches must be used, so that the number of cells connected to the mains may be varied, and the pressure on the lighting circuit kept constant. And as the number of cells connected to the lighting circuit must be altered, so also must regulating switches be provided to vary the number of cells connected to the charging dynamos, in order that the end cells may be equally charged with the rest. These regulating switches are indicated in Fig. 1. It is extremely important to watch that the charging switches are never connected to a less number of cells than the discharging switches, or else the intermediate cells will be liable to be charged in the reverse direction.

It will be found practically impossible to prevent unequal charging and discharging of the end cells, particularly if there be any load on the mains while the charging is going on. Nothing is more liable to upset a battery as a whole than to have any cells unequally charged with the rest. Even at a little sacrifice of efficiency the battery should, as far as possible, be charged and discharged as a whole, in order that every cell may be equally treated. This is hardly possible by the arrangement shown in Fig. 1. Unequal use of the cells leads to unequal capacities, with the liability to reversal and all its consequent troubles.

For these reasons the arrangement shown in Fig. 2 is much to be preferred.

All the dynamos are connected directly across the outers, the two smaller ones having a middle wire connection as well. There are no regulating switches required at all, except when the battery is being discharged. The dynamos at all times give the voltage required on the bus-bars, and there is no need whatever to vary their pressure on account of the charging of the cells. The extra voltage required for the charging is added to the voltage of the bus-bars by means of a small "booster" in the cell charging circuit, and the rate of charge can be varied to any extent simply by varying its excitation. The boosters can be carried on extensions of the shafts of the smaller units, or may be motor driven if desired.

Each side of the battery may thus be charged and discharged as a whole, and when discharging its pressure is varied by means of back EMF. cells as indicated.

A sign of the times is the tendency to favorably consider the use of accumulators in sub-stations. They should be charged directly from the mains during periods of light loads, the extra voltage being obtained by means of motor-driven boosters. Not only the station plant but also some of the mains may by this means be kept economically loaded.

ALTERNATING CURRENT LIGHTING STATIONS.

Contrary to the general practice of engineers who have to use alternating current plant, the writer has for many years advocated the use of accumulators in such stations. Their uses are two-fold. They can be used as a standby for the exciting plant, and also, particularly in small stations, to keep up the supply during the hours of light load, through the medium of a motor-alternator. The day load plant could conveniently consist of an engine, alternator and dynamo on the same shaft, with a clutch coupling between the engine and the machines.

The alternator and dynamo should each be of the same output, and the engines sufficient to drive either at full load, or both at half load. During the daytime the engines would drive both, the alternator for whatever lighting there may be on the mains, and the dynamo for charging the cells. As the lighting load increased, so the charging current would be decreased, keeping the load on the engine constant. When it was desired to use the discharge from the cells, the engine would be uncoupled, and the dynamo, run as a motor, driving the alternator. This may be done either at the time of the "peak" of the load, thus reducing the demand upon the boilers, or at any time when there was only a small load on the station, such as after midnight or on Sunday mornings, so that a number of the staff may be relieved.

If the alternators be excited from bus-bars, fed by a common exciter or exciters, the cells would be joined in parallel with them, and the charging dynamo would take the place of all or some of the exciters.

If each alternator have a separate exciter, then change-over switches should be provided, so that the cells may be used on any machine when required, instead of its own exciter.

TRACTION STATIONS.

Accumulators have earned for themselves a bad name in connection with traction systems, because they have in most cases been carried upon the cars, each set having only its own car to propel. The result of this has been not only large cost in handling, owing to the removal of the discharged cells *en bloc*, and the substitution of a freshly charged set every few hours, but also rapid deterioration conse-

* Paper read before the Municipal Electrical Association, London, June, 1898.

quent upon the shaking and the heavy electrical strains due to frequently starting the cars.

With only one car to run, each set of cells has to be large enough for the maximum current taken at any time by that car, the average working current being not more than one-third the maximum. But when a number of cars are run from one battery, fixed either in the generating station or in a sub-station, a far less jerky curve is obtained. Owing to the improbability of all the cars starting together, the maximum output is much lower in proportion to the average output, and the strains on the cells are much reduced.

Large transformers in sub-stations are much more efficient, and with a given capacity in kilowatts will allow of much larger lamp connections than a number of small house transformers. In a similar way large batteries in stations or sub-stations are much more efficient, and with a given output will maintain a much larger car service than if divided amongst a number of cars.

Owing to the rapidly fluctuating load, the plant in a traction station is generally working only at a low average load factor. The machinery running must be capable of meeting the maximum demand, while the average load does not probably exceed one-half of the maximum. The advantages of accumulators are most apparent here, and the wonder is that more traction stations do not use them.

In the first place the accumulators would take the peaks of the load, thus relieving the machinery of the sudden jerks due to starting the cars, and in the second place the amount of running plant could be reduced to that sufficient for the average load.

The curves that were taken from an actual tramway system having eight cars running showed that the pressure varied from about 495 to 510 volts, the current taken by the cars from 300 to 375 amperes, and the dynamo output from about 115 to 150 amperes.

Without the accumulators, sufficient machinery would have to be kept running to supply the maximum load of 375 amperes, although the average load was not greater than about 150 amperes. As it is, one dynamo will easily do the work instead of two, and can be kept at a very regular load throughout the whole time, so regular in fact that lighting could easily be done from the same machine.

The cells in this case were connected as a whole directly to the bus-bars, in parallel with the dynamo, no regulating switches being used.

In order that the accumulators shall take their share of the load in this manner, it is necessary that they should be of ample size for the work, with a low internal resistance, and the dynamo should be shunt wound with a falling characteristic. When it is required to fully charge the cells a booster is generally used.

In order to assist the battery to discharge when the total load exceeds the output of the dynamos, and to charge when the load is less, a compound wound booster is sometimes used, in the manner indicated in Fig. 3.

The booster, which in the figure is shown motor driven, has two field windings in opposition to one another. When the line current is equal to the output of the dynamos, the two windings must neutralize each other, and the booster will give no pressure. Then the battery will neither charge nor discharge. When the line current is less than the output of the dynamos, the shunt winding will predominate, and the booster pressure will be in the right direction for charging the cells. When the line current is greater than the output of the dynamos, the series winding will change the polarity of the booster, so that it will add a pressure to the battery circuit, and thus help it to discharge. By means of the switch S, the battery can be connected directly to the line when required.

Prof. Mengarini of Rome uses automatic switches to vary the number of cells in the accumulator circuit, so that with a fixed machine voltage the battery may be charged and discharged at such rates as to maintain a constant output for the machines. At Leeds, also, automatic switches are used for the same purpose, worked by means of a relay and small motor. The great complication, however, introduced by the use of automatic switches, and the evils attendant upon the irregular charging of the end cells, are strong arguments against their use.

From the curves taken it was shown that if the battery be large enough for its work, and the dynamos shunt wound with a sufficiently drooping characteristic, it will not be necessary to use either a compound wound booster or regulating switches, in order to keep a steady load on the dynamos. It would be very interesting to know whether the automatic switches gave any trouble at Leeds, and whether they are still used.

Besides being used in the generating station, accumulators can be of great service in sub-stations, at the far end of long traction systems, for the purpose of keeping up the line pressure. They can be either charged by means of a special feeder from the generating station, or directly from the line during periods of light load, with the help of a booster.

A system of some interest is the combination of cells carried upon the cars, with the use of the overhead conductor, as at Hanover. In those parts of the town where the trolley wire is not permitted, the cars are run from the cells carried by them, while outside the town the ordinary trolley system is in use. The cells can be charged in position from the trolley wire, or at the station in the ordinary way.

Accumulators used in the generating station, or in sub-stations, should be mainly charged during the time the cars are not running, say from midnight to 6 A. M. During the remainder of the day they would be in parallel with the generating plant, to be used as required.

COMBINED LIGHTING AND TRACTION STATIONS.

The addition of a lighting load to the ordinary traction station may not be of much benefit to the latter, but the combination of a tramway and lighting load will be of great service to the lighting station. Attention was drawn to the many advantages to be gained by the lighting station from this combination, in a paper presented to this Association at its 1896 Convention, of which the writer was joint author, and a number of the practical points were considered in a contribution by the writer to *Lightning*, in November of the same year. It will not be necessary therefore to deal more than briefly with the subject at the present time.

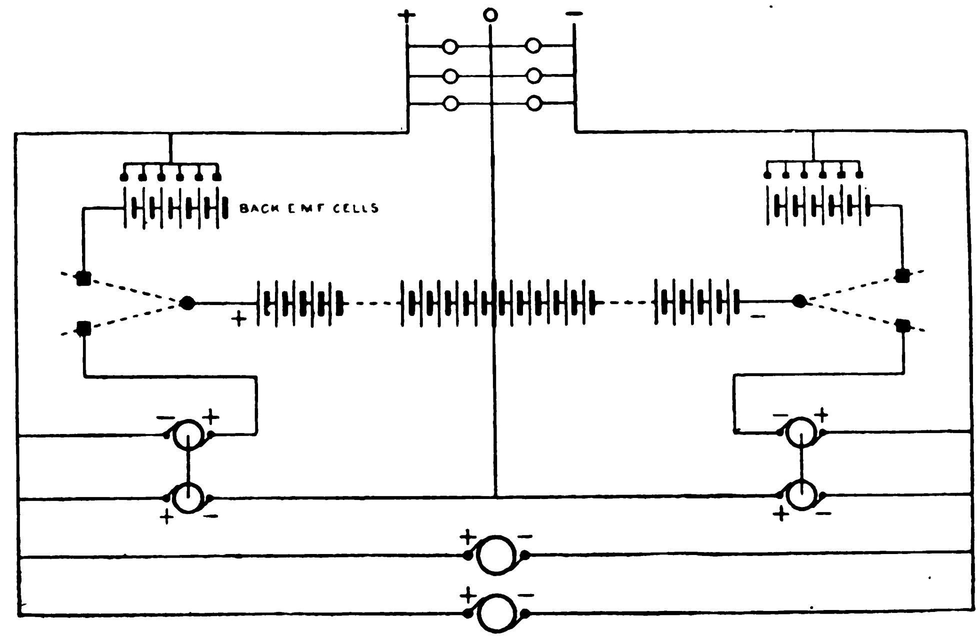

FIG. 2.

In arranging a combined lighting and traction station, the one aim of the engineer should be to use as much of the plant as possible for the combined purpose. The boilers and steam piping would be common in any case, and the engines (at any rate during the daytime) could be used to drive the lighting and traction machines at the same time. The exact method of arranging the plant would depend upon the local conditions, but by adopting one machine for traction and the other for lighting, the combined load could be taken by the same engines. A battery of accumulators properly arranged would prevent the fluctuations of the tramway load from affecting the lighting. During the evening, both machines could be used for lighting if desired, leav-

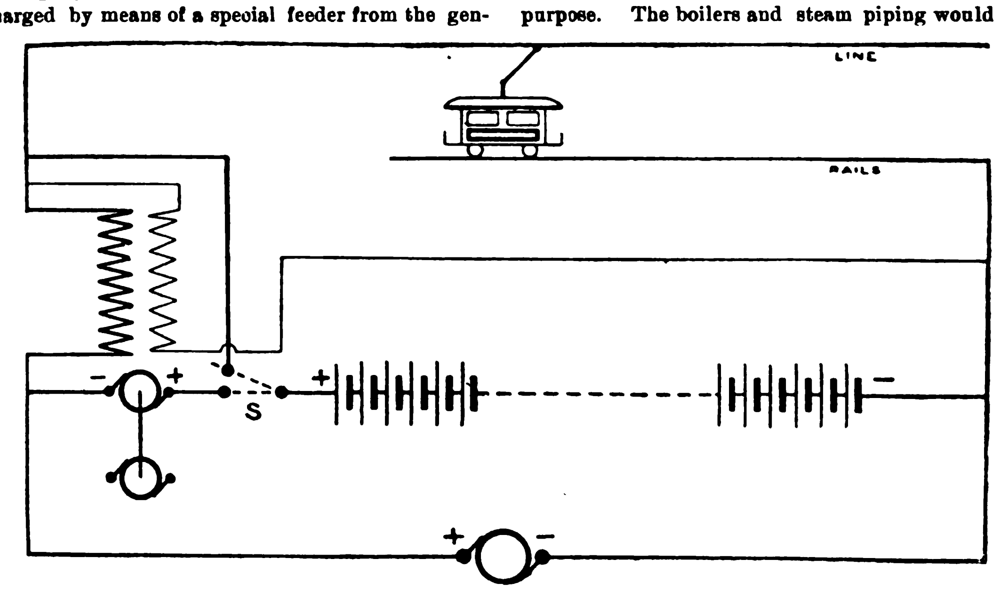

FIG. 3.

ing the accumulators to deal with the traction. After midnight the battery would be charged.

With a proper relation between the tramway load and the lighting load, it should be possible to have a nearly constant output for the boilers and engines throughout the 24 hours. The accumulators would look after the fluctuations in the daytime, and take the overlapping of the loads during the evening.

Before closing, the writer would like to draw attention to, and protest against, what seems to be a common practice amongst accumulator manufacturers. When maintenance rates are asked for and received, it will generally be found that, unless the capacity has been specified by the customer, the contractor will have offered to maintain the battery to not greater than from 60 per cent. to 70 per cent. of its original capacity. When a battery is put in to do certain work, it ought to be understood that its full capacity would always be required. But from the fact that most contractors will not offer to maintain 100 per cent. capacity without excessive terms, it would appear that batteries, as a rule, are rated too high in their lists.

ALUMINUM MANUFACTURE, WITH DESCRIPTION OF THE ROLLING-MILLS AND FOUNDRY AT MILTON, STAFFORDSHIRE.*

BY E. RISTORI.

(Concluded from page 72.)

Heavy Alloys of Aluminum.—There are many heavy alloys of aluminum, in addition to the well-known bronzes; some of these have not yet reached the development to which their valuable qualities entitle them, and which they will ultimately attain when better appreciated by mechanical engineers. Aluminum bronzes are undoubtedly superior in strength to most of the copper-tin bronzes now in use, and they are especially suitable for marine engineering. Propellers of aluminum bronze have been successfully made for most of the 26 and 30 knot torpedo-catchers, also a large number for the French Government. The two classes of bronze most frequently employed are marked R3 and R4. The difference between them is simply in the proportion of aluminum they contain. The following tests show their maximum, minimum and mean breaking loads and elongations, agreeably with which R3 has a guaranteed tensile strength of 35 tons per square inch with 25 per cent. elongation in 2 in., and when cast R4 breaks at 40 tons per square inch, with 10 to 12 per cent. elongation also in 2 in. These have the advantage of being considerably cheaper than other bronzes, are easily employed for any foundry work without special appliances or tools:

	Breaking load. Tons per square inch.			Elongation. Per cent. in 2 in.		
Mark.	Max.	Min.	Mean.	Max.	Min.	Mean.
R 3	43 7	39 6	41 8	13.00	6.50	9.75
R 4	36.6	30.8	34.0	35.00	15 50	23 30

Uses of Aluminum.—The principal uses of aluminum are too many to be enumerated. The properties of the metal are so akin to those of copper and brass that, broadly speaking, aluminum or one of its light alloys should to a large extent replace both copper and tin and also nickel or german-silver. Such a change would be followed by various advantages to all concerned. Not only would there be a considerable reduction in the weight of the articles, but they would not tarnish nor turn black on exposure to air. The cost should be the same, if not actually lower, inasmuch as, bulk for bulk, aluminum is already cheaper than copper or tin, and its price will continue to fall as the demand increases. One field, however, remains, which copper is bound to maintain as its own—namely, the construction of insulated electrical conductors. Experiments have already been made on a large scale with bare conductors of aluminum for telephones, etc., and the British Aluminium Company are using it in this manner at their Foyers works with perfectly satisfactory results, its conductivity, weight for weight, being double that of copper. But when the mains have to be insulated, copper is absolutely unapproachable, on account of its greater conductivity volume for volume, which is 165 per cent. of that of aluminum. Besides the advantages set forth above, aluminum is not poisonous, and is pre-eminently adapted for the manufacture of cooking utensils. On the other hand, tinware is not particularly cheap in the long run, for it is constantly wearing out; cast iron is heavy and brittle; and copper requires to be frequently retinned in order to avoid all danger to health. Inasmuch as an aluminum saucepan costs no more in the first instance than a copper one, weighs much less, is perfectly innocuous, and does not periodically need a fresh inside, it is not surprising that the employment of aluminum in kitchens and canteens is spreading rapidly.

A steady demand for aluminum is springing up in various kinds of printing processes as well as in lithography. The metal appears to answer admirably for the construction of rollers used in calico printing; and when its surface is properly prepared it is also capable of replacing the ordinary lithographic stone. It can easily be imagined that, instead of having cumbrous and heavy stones, which can be printed only on special slow-running "litho" machines, it is far better and cheaper to use thin sheets of a metal which can be bent into a circular form and printed on rotary presses. Bicycles of all kinds, electric light fittings, chains, bridles, stirrups, surgical instruments, sextants and other scientific apparatus, keys, cigar cases, pen and pencil holders, toilet articles, plates and dishes, spoons, forks, frames, name-plates, door furniture, hat and coat pegs, boot-trees, fire-engine fittings, business and visiting cards, photographic cameras, etc., are a few of the things that are being daily made in aluminum by various firms, and all these articles should be sold at the same price as if they were composed of brass. There are other instances where aluminum should economically replace commoner metals than copper or brass. Wherever a great deal of dead-weight has to be continually moved about, the cost of motive power, for which there is apparently no return, is serious, and if this unremunerative weight can be reduced to one-third of its present amount, in the course of a year or two the saving in power will more than compensate for the greater initial outlay. Thus frames for cabs and motor cars have already been made in aluminum; and though in England experiments have not yet been tried in this direction, aluminum railway carriage frames are under review in France. Especially for motor cars there should be a large field here for aluminum. A further demand for the metal will be brought about by its introduction into the military services. All parts of the soldier's equipment have practically been made already in aluminum, such as mess-tins, water-bottles, buttons, helmets, parts of rifles, cartridge-cases, fittings for guns, tents, horseshoes, portable bridges, etc. Nothing much has yet been done in England in this direction, but it is well known that Continental armies, notably that of Germany, are employing aluminum on a large scale. One of the largest uses to which aluminum has been applied is in metallurgy, where its valuable metallurgical properties were discovered and utilized. It is common knowledge among steel-makers that ingots often turn out spongy at the top; and when particularly good ingots are required, the faulty portion is cut off and melted over again. By the introduction of a very small proportion of aluminum to iron, steel or brass, either in the mold or in the ladle, the founder can be quite certain that the ingots will be solid all through. When used in this way, aluminum has the peculiar virtue of instantly liberating all the gases contained in the metal, and of keeping it fluid for a longer period, so that by the time the casting solidifies, the gases have had an opportunity to escape. In almost all steel works, and in all the principal foundries, aluminum is now being employed; and reports from some of these state that the result is a reduction in the wasters by 80 to 90 per cent. In this case aluminum does not actually replace any other metal, but by its own special qualities is useful as a means of improving physically and chemically some of its older rivals and friends.

Aluminum in Shipbuilding.—The use of aluminum in shipbuilding is growing rapidly, on account of the almost inestimable advantage of its great saving in weight. Four or five years ago a small canoe was made on the Thames of two sheets of aluminum stamped and riveted together. In 1892 Messrs. Escher Wyss, of Zurich, constructed a small launch entirely of aluminum, driven by a naphtha motor; and in the following year they built for Mr. Nobel another larger vessel, which has been in use ever since, and is now on one of the Swedish lakes. During 1894 and 1895 the author had on the Thames between Windsor and Maidenhead a similar vessel, which is now at work at Foyers. A much more ambitious attempt was made by Messrs. Yarrow in 1894. By request of the French Government they built of aluminum the whole of a second-class torpedo-boat, 60 ft. long by 9 ft. 3 in. beam. This boat weighed in full working order, but exclusive of armament, only 9½ tons, and attained during a run of two hours, carrying a load of three tons and with the engines indicating about 300 HP., a mean speed of 20¼ knots—an advance of 3½ knots over all previous records. Several yachts, including the "Vendenese," were also constructed at the same time, but they do not seem to have been a real and permanent success, owing probably to the adoption of an unsuitable metal. As pure aluminum was not strong enough alone, it was thought better to use an alloy containing about 6 per cent. copper in the construction of some of these boats. This alloy possesses a tensile strength of 14 tons per square inch; but, as already stated, this material is absolutely untrustworthy in sea-water, owing to the rapid corrosive action set up between its two ingredients. Moreover, although nobody would dream of employing any other metal than copper for plating sea-going vessels unless it were afterwards painted, aluminum has always been used bare, which the author considers a mistake. If the aluminum were protected from direct contact with the water, it would have lasted much better. Unfortunately this comparative failure has materially discouraged the adoption of aluminum in shipbuilding; and although it is now well recognized that the pure metal, and several of its alloys which do not contain copper, stand the action of salt water better than iron or steel, some time is likely to elapse before these premature tests are forgotten. Eventually, however, when further experiments have been carried out, there is no reason why a suitable alloy should not be adopted which, when properly used and protected from direct contact with sea-water, would resist corrosion as effectually as the majority of materials now employed in shipbuilding. These remarks refer only to the keel and other parts of the vessel below water, and chiefly to such craft as are to navigate the open seas. For all internal work aluminum is perfectly safe, and it is especially suitable for adoption in the navy, where the presence of wood and other inflammable material should be discouraged as much as possible lest it lead to fires during action. In all boats sailing on fresh or inland waters the corrosion is less, and when portability is desired, as in the case of expeditions to little known parts of the world, even if the aluminum do suffer corrosion, this is of trifling moment in comparison with the advantage of smaller weight to be transported. For instance, Messrs. David White of Glasgow have recently constructed an 18 ft. boat for a party going to Klondyke, weighing only 1¾ cwt.; it is wholly composed of aluminum, even to the rivets,

* Paper read before the Institution of Mechanical Engineers, Derby, Eng.

nails, bolts and nuts. It is made in sections which pack into one another, and the whole can be put into a box. Messrs. Forrestt & Son of Wivenhoe have also furnished a flotilla of two launches and a barge for Major Gibbons's trans-African expedition which started in May. The vessels are built in sections on the Hodgetts principle, each piece measuring about 6 ft. 6 in. by 3 ft. 9 in. and weighing less than 120 lbs., so that two natives can easily carry one between them by means of oars on their shoulders. The chief peculiarity of these boats lies in the interchangeability of the 20 sections composing the fleet. The different pieces can be put together in a variety of ways, forming three separate boats of such sizes as may be most convenient at the moment; it is possible to have either two 26 ft. launches and one 22½ ft. barge; or one 44½ ft. launch and two 15 ft. barges; or one 37 ft. launch, one 22½ ft. barge, and one 15 ft. barge, etc. One launch is fitted with an awning, the other carries a mast and sail.

THE MEASUREMENT OF THE EFFICIENCY OF DYNAMOS.*

In an article which was published in the *Revue de Physique et de Chimie*, M. Bunet describes various methods of testing the efficiency of electrical machinery, and discusses the relative advantages or disadvantages of the several methods. He divides them into two classes, in one of which the energy absorbed by the machine, P_a, and the useful energy delivered by it, P_u, are measured, whence the efficiency $\eta = \frac{P_u}{P_a}$, whilst in the other P_a or P_u is measured, and also the losses, p, whence the efficiency $\eta = \frac{P_a - p}{P_a}$, or $\frac{P_u}{P_u + p}$. In the first case measurements of electrical energy and of mechanical energy must generally be made, and the measurement of the latter presents considerable difficulty and cannot be made with the same accuracy as electrical measurements. The exception is where a motor and dynamo are coupled together and the electrical energy delivered by the dynamo is compared with the electrical energy absorbed by the motor, but in this case a difficulty arises in properly apportioning the losses between the two machines owing to the different conditions under which they are working.

Dealing with the first class of tests, the author mentions the method of measuring the mechanical energy absorbed by the dynamo by means of a transmission dynamometer, but finds it unsatisfactory on account of the want of accuracy of this instrument; the method of indicating the engine running light and driving the dynamo, and the method of determining the efficiency of the engine with a brake when it is running under the same conditions as when driving the dynamo; but both these latter methods are condemned as inaccurate. If the electrical machine to be tested is a motor, the brake method can be used and will give, with due precautions, results in which the error will not exceed 1 per cent. With regard to the method in which the dynamo is driven by an electric motor, the author proposes the use of a motor the efficiency of which has previously been determined, and this is a very convenient method of checking the efficiency of dynamos during their final run before delivery; but if a really accurate test of the efficiency is required, it appears to us that a method should be used which does not depend for its accuracy on the reproduction of exactly the same conditions in the motor at different times, and that it would be preferable even to test the dynamo machine as a motor by the method that has been considered good enough for the determination of the efficiency of the driving motor.

M. Bunet discusses this question of the relative efficiencies of the same machine as dynamo and as motor, and concludes that if the machine is in each case run so that the induced electromotive force is the same, and with the same currents through the armature and magnets, then the speed will be the same and the magnetic flux also. In such a case the C^2R losses are the same, as also are those due to friction, hysteresis and eddy currents, and if E is the induced electromotive force, C the current in the armature, R its resistance, W the losses due to friction, hysteresis and eddy currents, and W' the loss due to the exciting current, which is supposed to be supplied from a separate external source, then the efficiency of the dynamo will be

$$\eta_d = \frac{EC - C^2R}{EC + W + W'},$$

and that of the motor will be

$$\eta_m = \frac{EC - W}{EC + C^2R + W'}.$$

These two ratios will be very nearly equal, it is said, because the values of C^2R and W differ but little in most machines. M. Bunet assumes that the lead of the brushes is the same in both cases, and that the armature reaction requires the same compensating ampere-turns in the excitation, and says that this is borne out by his experience; but although the difference may be small, we should prefer to make the test by adjusting the exciting current till the speed was the same when the motor was supplied with current at a terminal potential difference equal to the terminal PD. of the dynamo plus twice the calculated drop in volts in the armature.

In the second class of tests M. Bunet first mentions the method proposed originally by Mr. Swinburne, in which the machine is run light as a motor at its normal speed with the magnets excited so that it runs at this speed when supplied with current at a pressure equal to the total EMF. it would generate at full load as a dynamo. Under these conditions, the speed and magnetic flux being the same as when running at full load as a dynamo, the watts supplied to the armature can be taken to represent the sum of the losses due to friction, hysteresis and eddy currents. The C^2R losses are then calculated from the measured conductor resistances of the armature and magnet windings, and the total losses obtained by adding to the C^2R losses the watts supplied to the armature when running light. It is often held that this method gives too high an efficiency, but M. Bunet gives comparative figures of tests by the Swinburne and other methods which show that this is not so to any appreciable extent. For example, a series motor supplied with 35 amperes at 230 volts had an efficiency measured by the brake of 86.3 per cent., and by the Swinburne method of 87 per cent.; a second motor receiving 25 amperes at 230 volts had an efficiency by the brake of 84.4 per cent., and by the Swinburne method of 83.7 per cent.; whilst a third motor receiving 40 amperes at 230 volts had an efficiency by the brake of 88.3 per cent., and by the Swinburne method of 87.5 per cent. Again, two dynamos of 600 volts and 410 amperes at 425 revolutions were tested by the Hopkinson method, being coupled together by a belt, and had an efficiency of 91.3 per cent. at full load, while by the Swinburne method the efficiency worked out at 92.5 per cent. A series of tests taken at various currents from 150 to 415 amperes gave efficiencies by the Swinburne method which were from 0.4 per cent. to 1.2 per cent. higher than those obtained by the Hopkinson method, but this is only what would be expected as in the latter cases the loss in the belt drive is included.

The method employed originally by Dr. Hopkinson consisted in coupling together mechanically and electrically two similar machines, one of which ran as a generator and supplied current to the other, which, running as a motor, supplied the greater part of the mechanical energy required to drive the generator. The energy required to make up for the losses in the two machines and to keep the combination running was supplied from an engine or other motor and was measured by a transmission dynamometer. Besides possessing the advantage that when testing large machines it is only necessary to supply from an external source less than a fifth of the energy that would be required to drive one of the machines as a dynamo, there is the further advantage that an error in the dynamometer reading causes a much smaller percentage error in the efficiency. M. Bunet says that an error of 5 per cent. in the dynamometer only causes ¼ per cent. error in the efficiency if this is about 90 per cent.; but this is a slip and should be ½ per cent., unless when he speaks of an efficiency of 90 per cent. he means that the efficiency of the combination of two machines is 90 per cent. The transmission dynamometer is not now much used, and the method of making this test has been modified so that all measurements are electrical, the energy required to make up the losses being supplied by a dynamo which is coupled up either so that it works in parallel or in series with the generator under test. In the former case the auxiliary dynamo must supply current at the same voltage as the machines under test, while in the latter case it must be capable of carrying the main current in its armature, and of the two methods M. Bunet recommends the former, because it is easier to regulate the speed of the machines.

There has been a good deal of discussion at various times as to the proper way of deducing the efficiency of each machine from the combined efficiency of the two, which of course is what is actually measured by the test. M. Bunet says that if the square root of the combined efficiency is taken as the efficiency of each machine, an error of as much as 2 per cent. may be made, according to the conditions under which the machines are run. He recommends as the best conditions for making the test, that if E is the normal voltage, C the normal current, and R the resistance of the armatures, the dynamo should be run so that at its normal speed it gives a potential difference at the terminals of $E + CR$. The magnetic flux in the dynamo will then have to be increased from the normal in the proportion of $\frac{E + 2CR}{E + CR}$, and that in the motor diminished from the normal in the proportion of $\frac{E}{E + CR}$; but as this increase and decrease are small, say 2 or 3 per cent., and as the mean of the two fluxes is practically equal to the normal flux, no appreciable error is made in assuming that the losses in one machine in hysteresis and eddy currents under normal conditions are equal to half the losses from the same cause in the combination. The same applies to the friction losses as the machines are running at the same speed, and to the exciting current losses as the normal exciting current is practically the mean of those in the generator and motor under test conditions. The current in the motor armature will, however, be greater than that in the generator armature by an amount equal to C_1 if that is the current supplied by the auxiliary dynamo, and to correct for this M. Bunet gives the following formula for the efficiency of one machine as a dynamo:

$$\eta = \frac{EC}{EC + \frac{EC_1}{2} - \frac{R}{2}\left\{(C + C_1)^2 - C^2\right\}}$$

As the C^2R losses in the armatures and magnets can so easily be separated out, the writer prefers to calculate them and deduct their sum from EC_1, and then allot half the remainder to each machine as the sum of the friction and core losses, and to calculate

*From the *Electrical Review*, London.

the efficiency of the machine as would be done if the Swinburne method had been employed.

If the auxiliary dynamo is connected in series with the machines under test the best conditions are those which make the mean of the potential differences at the terminals of the dynamo and motor armatures equal to the normal voltage, i. e.,

$$E_d + \frac{e}{2} = E_m - \frac{e}{2} = \text{the normal voltage, where}$$

E_d, E_m and e are respectively the terminal potential differences of the dynamo, motor and auxiliary dynamo. For this test the writer prefers, if possible, to separately excite the magnets of the machines under test, reducing the excitation of the dynamo and increasing that of the motor so that the machines run at normal speed. In this case the current through both armatures is the same, the frictional losses are equal, and as the magnetic flux in the motor is as much above the normal as that in the dynamo is below, there is no appreciable error in assuming that the hysteresis and eddy current losses under normal conditions are equal to half the loss from these causes in the combination. The efficiency of either machine as a dynamo at its normal output of E volts and C amperes is

$$\frac{E\,C}{E\,C + \frac{e\,C}{2} + W'}$$

where e is the potential difference of the auxiliary machine and W' the watts lost in excitation at normal load.

There is, we think, no doubt that the Swinburne and Hopkinson methods of testing are far ahead of any others in accuracy, and that the choice of one or the other method may be determined simply by which is the more convenient in any particular case. If there are not two similar machines available, the Swinburne method should be employed, and the conductor resistances should first be measured cold; the dynamo should then be run at full load for several hours and the conductor resistances again measured hot, and after this the machine should be run light as a motor to determine the friction and core losses. If two similar machines are available, the Hopkinson method is preferable, as the full load test only requires an engine or other motor capable of supplying a fraction of the power absorbed by the generator, and it is not necessary to have resistances to carry the output of the dynamo. The writer has found no difficulty in making the test under good conditions with the auxiliary dynamo in series with the machines under test, and finds so little difference in the two methods that one or the other may be used according as the output required from the auxiliary dynamo will best suit an available machine.

THE ASHCROFT ZINC EXTRACTION PROCESS AT COCKLE CREEK.*

The Ashcroft zinc extraction process for the extraction of zinc from mixed sulphide ores by means of electrolytic deposition became the property of the Sulphide Corporation in the year 1895, and after trial at the experimental works at Grays, in Essex, steps were taken to test its value upon a large industrial scale at the Broken Hill Mines in New South Wales. In a recent article contributed to the *Elektrochemische Zeitschrift* by Dr. Richard Threlfall, a very full description of the process and of the plant erected at Cockle Creek is given, with illustrations of the generating plant, the leaching vats and the electrolytic tanks. Since the date of this article it has been publicly announced that the economic results of the first trial at Cockle Creek have not been successful, and that the electrolytic plant is to be shut down, while the operations of the Sulphide Corporation are to be confined to the concentration and smelting of the raw ores. On account, however, of the importance of this attempt to work the refractory Broken Hill ore by an electrolytic method, and on account of the probability that further efforts will be made to render the electrolytic process a success, we give our readers below a fairly full abstract of Dr. Threlfall's article.

The Broken Hill ore contains on the average 30 per cent. lead and 30 per cent. zinc as sulphides, with 25 oz. silver to the ton. Some portion of the lead is separated from the zinc in the concentrating plant, and the latter portion of the ore with its silver contents is then subjected to the Ashcroft treatment. This consists in first crushing the ore, and then roasting it under such conditions of temperature and access of air that the zinc sulphide is transformed into a mixture of oxide, sulphate and basic sulphate. The roasted ore is then charged into leaching vats constructed of wooden staves, and of circular form, where it is leached with a solution containing 10 grammes iron as chloride, and an equivalent amount of sodium sulphate per liter. The zinc passes into solution according to the following equation:

$$3ZnO + Fe_2Cl_6 + 3H_2O = 3ZnCl_2 + Fe_2(OH)_6,$$

while the iron, lead, manganese and silver remain in the leaching vat. The leaching is repeated with the same volume of solution until its zinc contents reach 30 grammes per liter. It is then freed from the small quantity of iron and silver which it contains by heating with zinc oxide, and by passing through filter presses in order to remove the precipitated impurities.

The solution of zinc chloride is now ready for the electrolytic procedure. This is carried out in wooden tanks 6 ft. by 6 ft. by 6 ft. constructed of California red wood, each tank being divided into four compartments by means of wooden partitions and canvas. Each tank contains 52 anodes and 48 cathodes, the dimensions of these being in every case 4 ft. by 1 ft. This comparatively small size enables them to be easily handled by the workmen. The anodes in two-thirds of the tanks are of iron, in the remaining third they are of carbon. The cathodes are in every case of thin rolled zinc, $\frac{1}{25}$ in. thick. It is not possible to clearly explain the electrode arrangement without the explanatory diagrams, but briefly it is as follows: The zinc chloride solution first traverses all the cathode compartments of the system of vats; in these zinc is deposited by the action of the current. The effluent from the cathode compartments contains 12 grammes zinc per liter (it is not economical to go below this limit), and it is now passed through the series of anode compartments of the same system of vats. In those containing iron anodes, iron is dissolved in equivalent amount to that of the zinc deposited, while in the remaining third this ferrous chloride is raised to the ferric state by the chlorine liberated at the carbon anodes.

The chemical equations for these reactions are as follow:

$$ZnCl_2 + Fe = FeCl_2 + Zn$$
$$2FeCl_2 + Cl_2 = Fe_2Cl_6.$$

The electrodes are connected in parallel, and the vats in series; the EMF. varies from 1 to 2.8 volts, according as iron or carbon anodes are used. The system of vats is so arranged that the whole number absorb 120 volts—the pressure at which the generating plant delivers the current in the vat house. A current-density of 5 amperes per square foot is obtained under these conditions, and the cathode area is sufficient to permit of 5,000 amperes being passed through the system under normal conditions of work. One of the great difficulties in zinc deposition is to avoid the formation of zinc sponge at the cathode. It is evident that there have been unpleasant experiences of this kind at Cockle Creek, and Dr. Threlfall states that Ashcroft has sought to overcome the difficulty by adding zinc oxide or caustic alkalis to the electrolyte before it passes into the cathode series of cells. He himself expresses doubts as to the value of this addition, and states his belief that unsatisfactory deposits of zinc are caused by small quantities of unrecognized impurities in the electrolyte. When once a solution of zinc has been obtained which yields a dense metallic deposit of zinc at the cathode, he states that current-densities varying from 2 up to 110 amperes per square foot may be used without detriment to the metallic characteristics of the deposit.

The generating plant at Cockle Creek consists of five Babcock & Wilcox boilers each of 500 HP. capacity. These supply steam to 5 Wilans engines direct coupled to 5 Siemens dynamos. The smaller machines deliver 1,100 amperes at 120 volts, the larger ones 2,200 amperes at 120 volts. Each dynamo is provided with a separate switchboard, through which it is connected to the common conductor. The electrolyte is maintained in rapid circulation through the electrolytic vats. This is effected by means of four large storage tanks placed at the end of each double row of depositing vats. These tanks are at different levels, and pumps are used to raise both the anode and cathode supply of electrolyte to the higher storage tanks, from which it flows by gravity through the system of vats back into the ower storage tanks.

The above plant was put into operation in March, 1897, and during a run of four months produced 150 tons of zinc. The economic results were, as already stated, unfavorable, and the directors of the Sulphide Corporation decided that if, after some alterations in the plant had been carried out, a second run of three months did not yield better profits, the electrolytic recovery plant must be stopped.

This second trial run at Cockle Creek was commenced in November last, and although no public announcement concerning the result has yet come under our observation, we hear from private sources that the production of zinc was again unsatisfactory and insufficient to give financial stability to the process. In view, however, of the money sunk in the machinery and plant at Cockle Creek, it is probable that further attempts will be made to render the process a success, especially as Mr. Ashcroft is understood still to have faith in the possibilities of the electrolytic method of treatment for refractory sulphide ores.

* From the *Electrician*, London.

LONDON NOTES.

[From our London Correspondent.]

The Caustic Soda Litigation.

Judgment has been given by Mr. Justice Bigham in the London Law Courts in the action brought by the Castner-Kellner Alkali Company against the Commercial Development Corporation, Ltd., for an infringement and to restrain further threatened infringement of letters patent No. 29,259, of 1894, for an improvement in electrolytic apparatus for decomposing metallic salts. His Lordship decided that plaintiffs were entitled to succeed, and he granted an injunction as asked for. The infringement consisted of the use of certain apparatus made according to the specification and other letters patent, No. 21,509 of 1896, belonging to the defendants.

Alternate Current Plants and the Zipernowski Patents.

Manufacturers of alternating current plant and those engineers responsible for alternating current lighting stations in this country are understood to be threatened with possible litigation by one Martin Rucker, who is stated to have purchased the Zipernowski & Deri transformer patents of 1885, and is now claiming royalties from users for infringement. The London electric lighting companies and some provincial municipalities have received letters to some such effect, and it is expected that they will combine to resist what are considered to be attempts to place a heavy tax upon electric lighting undertakings. The patents which are declared to be infringed are said to be respecting the working of transformers in parallel.

LEGAL NOTES.

The Second Appellate Division of the Supreme Court of New York has affirmed the verdict of a jury awarding $7,500 to Olga Paulsen for injuries received in jumping from a car of the Nassau Electric Railroad Company in Brooklyn on the 12th of August, 1896. The plaintiff while a passenger on the car with her 12-year old niece, becoming alarmed by the flashing from the controller or motor box situated at the front railing of the car, jumped from the car while it was in motion and fell to the ground, breaking her leg and receiving other severe injuries. In the action brought by her against the railroad company to recover damages, there was evidence tending to show that the flashing was of an unusual character; that the controller was out of order, and that the car had not been inspected before it left the depot on this trip. The Appellate Court, Justice Goodrich presiding, held that the question of the defendant's negligence was properly submitted to the jury and that the judgment should not be disturbed. It was held that negligence might also be imputed to the railroad company from the fact that the motorman, after the flashing or flaming began, permitted the car to continue its course without stopping to ascertain the cause of the flame, until a new element of apprehension was reproduced by the burning of the fuse.

At Trenton, N. J., on the 12th inst., Vice-Chancellor Emery denied the application of the township committee of Summit for an injunction restraining the New York & New Jersey Telephone Company from running its wires through certain streets in the township. The Vice-Chancellor says the poles upon which the wires are suspended are upon private property by consent of the owners, and where wires cross streets the consent of the owners of the land abutting has been obtained. The wires are suspended at an elevation which does not interfere with public travel. The township committee claimed that the telephone company had no right to suspend its wires across the public streets without the consent of the township committee. Not long ago the committee caused the wires to be cut and the company replaced them.

CANADIAN NOTES.

The Board of Governors of McGill University, Montreal, have appointed Prof. R. B. Owens, E. E., of the University of the State of Nebraska to the chair of electrical engineering at McGill.

The Jacques Cartier Water Power Company of Quebec has been organized with the authorized capital stock of half a million dollars. The company has acquired from the Standard Light & Power Company of Montreal its chartered rights to introduce electricity for light, power and heating throughout the city of Quebec. It is expected that the company will have the work in full operation on or before the first day of January next.

The Ottawa city council has passed the Metropolitan Electric Company's bye-law which lets in a new electric corporation to operate in Ottawa. The bye-law provides among other things that the company is not to charge for incandescent lighting more than one cent per ampere hour, with a discount of 40 per cent. and a further discount of 12 per cent. for cash within 15 days, off the lowest meter price. At the expiration of ten years the city has a right to acquire the property of the company at its actual cash value. The company has made arrangements for obtaining its water power at the Chaudiere Falls and has already secured over 2,000 horse power to begin with and an option for 5,000 more if needed.

Personal.

Mr. Martin J. Insull, brother of Mr. Samuel Insull, president of the Chicago Edison Company, who has until recently been connected with the well-known firm of Sargent & Lundy of Chicago, has opened an office in that city at 1013 Monadnock Block, as manufacturers' agent, and will continue to handle dynamos, motors, incandescent lamps and other electrical appliances. He has our best wishes, and with his well-known ability cannot but make a success of the undertaking.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING PLANTS.

Abilene, Kan.—An electric light plant is to be built here at once, the council having voted to light the streets with arc lights.

Bristol, R. I.—The consolidation of the Bristol Gas & Electric Lighting Company and the Narragansett Electric Lighting Company of Providence having been completed, the plants of Bristol and Warren will be closed and all the electricity needed for those places will be furnished from Providence. The new corporation, which retains the name of the Providence company, is capitalized at $200,000, and its officers are as follows: President, Samuel P. Colt; vice-president, John Waterman; treasurer, Wm. R. Bogert; board of directors: Samuel P. Colt, Leander R. Peck, John Waterman, Marsden J. Perry, B. M. Bosworth, Wm. T. C. Wardwell, J. H. Manchester, Joseph W. Martin and Wm. Russell Bogert.

Brooklyn, N. Y.—The Edison Electric Illuminating Company's bids for supplying the borough of Brooklyn with electric lights were as follows: For more than 3,500 lights, each of 1,200 candle power, 34 cents each per night; 600 candle power, 17 cents per night; for less than 3,500 lights, each 1,200 candle power, 35 cents each per night; 600 candle power, 18 cents each per night; for public buildings, 16½ cents per KW. hour for current furnished. These are the same as last year's contract prices, and as the company was the only bidder, will probably be accepted. The Edison Electric Illuminating Company is the one which has been practically absorbed by the Kings County Electric Light Company. The Kings County Electric Company's bid, made when the proposals were first advertised, was 31 cents per night; that of the Edison Company, 35 cents per night. The specifications called for the lighting of all Brooklyn by one company. Corporation Counsel Whalen handed down an opinion in which he said this specification should be eliminated and a readvertisement of the proposals made. This was done, but not until several weeks had passed. In the meantime the Edison Company had been absorbed by the Kings County Company.

Caro, Mich.—The local electric light plant has been purchased by Charles Montague and J. H. Harris. The purchase includes all the property surrounding the plant—elevator, tile yards, stock yard, etc. A stock company is being formed with a capital of $30,000, under the title of "The Caro Light, Power & Grain Company," and as soon as the articles of association are filed with the Secretary of State the stock books will be opened.

Chicago.—A deal is said to have been completed by which the Chicago Edison Electric Light Company has absorbed every important corporation now furnishing electric light within the city limits. The companies which have been absorbed are: Hyde Park Thomson-Houston Light Company, Hyde Park Electric Light & Power Company, People's Light & Power Company, People's Electric Light & Motor Power Company (town of Lake), Mutual Electric Light & Power Company (Hyde Park), Englewood Electric Light Company, West Chicago Light & Power Company, Western Light & Power Company (Lakeview), Edgewater Electric Light & Power Campany, Chicago Sectional Electric Light Underground Company, Commonwealth Electric Light Company.

Dickson, Tenn.—The Business League is considering a proposition to light this town with electricity.

Gallatin, Tenn.—The board of aldermen has decided that the town should put in an electric plant at its own expense and not give the franchise to any firm or corporation.

Herington, Kan.—The council has determined to close down the city electric light plant owing to the excess of expenses over receipts. The deficiency up to the end of last year was $5,200, and for some time it has been running behind at the rate of $150 to $200 a month.

McArthur, O.—Bids will be received by the trustees of the electric works of this village until the 25th inst. for furnishing machinery, material and performing the labor necessary for the construction of an electric lighting system for the village. Bids must be addressed to James W. Darby, clerk, at whose office plans and specifications can be seen.

Mystic, Conn.—The plans for starting an electric light plant in this village are maturing. A company is already organized with a special charter, and it only remains to elect directors and officers and to provide for an increase of the capital stock to $15,000. Thomas C. Perkins of Hartford is the promoter of the project.

New Orleans.—The fire and lighting committee of the council has shaped an ordinance embodying the requirements to be met in submitting proposals for lighting the public buildings, parks, etc., for a term beginning in March, 1899, and ending on the 31st of December, 1902, and the city attorney having approved the ordinance, it has been sent to the council. The document is published in full in the "Picayune" of the 6th inst.

Paris, Tex.—Bids will be received at the mayor's office until September 1 next for the lighting of this city with electric arc lights for a period of from one to five years. The bids must be for not less than 60 nor more than 100 arc lights, and must be accompanied by a certified check for $500.

Penn Yan, N. Y.—The Penn Yan Electric Light & Power Company has signed the lighting contract for another year. The price agreed upon is $3,876.

Providence, R. I.—The consolidation of the Bristol County Gas & Electric Company with the Narragansett Electric Lighting Company has been effected.

Torrington, Conn.—The Torrington Electric Light Company has voted to increase its capital from $24,000 to $50,000, for the purpose of putting in a gas plant in addition to its electric lighting system.

Vicksburg, Miss.—The recent explosion of a cylinder in the electric light plant here caused more damage than was at first supposed. The damage is now estimated at $1,000, and it will take two weeks to put the plant in order.

Wellington, Kan.—The prospecting for water on the Ninnescah, near Belle Plaine, is progressing satisfactorily. If sufficient water can be found, the city council will have the water piped to this city, and will also have an electric plant erected there and current transmitted to the city for lighting purposes.

STREET RAILWAYS.

Ballston Spa, N. Y.—The Ballston Terminal Railroad is completed to a point within one and a half miles of Rock City Falls. It is quite unlike any other trolley road in existence, designed mainly to carry freight from the various large paper and pulp mills and iron factories along the Kayaderosseras, yet it runs through some of the most picturesque scenery in the State and is quite likely to become a very popular road for passengers who like a pleasant ride through the country which it traverses.

Brooklyn, N. Y.—The Brooklyn Elevated Railroad Company will begin changing the motive power of its road next month. About two thirds of its mileage will be equipped with the electric system, and on this portion of the line steam locomotives will be altogether abandoned. The cost of the change will be in the neighborhood of $800,000.

Brockton, Mass.—A new signal system has been introduced on the Taunton & Brockton street railway. It is called the Skeen automatic semaphore signal system and is made by the Skeen Company of St. Louis. The Brockton, Mass., "Times" states that the Brockton company was the first to make application for the use of it on the road between Brockton and Taunton. It is a complete block system, front and rear, and its principal virtue lies in the fact that it is entirely automatic. No hand is needed to operate it, no eye to guide it. A man may sleep at his post, and still it works as though he were awake, and it is never out of order. It is similar in a certain respect to the signal system used extensively on the steam railroads, being worked by electrical contact. The Skeen system is operated from the trolley, and throws a red light ahead and a white or "telltale" light behind, to show that everything is all right. Besides the lights, it operates semaphores, which work independently, and these, even if the lights fail to work, notify the motormen of all changes.

Chicago.—Two storage batteries of 500 KW. capacity, or 700 horse power each, are being installed by the South Side Elevated Company. The installation is being supervised by Sargent & Lundy, and is expected to be completed by September 30. The batteries are to be used for the purpose of evening the load on the engines.

Elizabeth, N. J.—Judge Van Syckel has refused to issue an injunction restraining the Union County board of freeholders from granting a franchise to John Kean to construct a trolley road on the main county road from Elizabeth to Plainfield, for which Mr. Kean has offered to pay $250,000. The Union County League, which is opposed to the scheme, petitioned the court for the injunction which has been refused.

Erie, Pa.—E. T. Moore, of this city, who is interested in the new electric line between Erie and North East, says that parties in Cleveland are pushing a movement to build a line from Painesville to Conneaut, O., and that the line may be later on extended westward to Erie to connect with the North East and Erie motor line. Mr. Moore says it is only a matter of a few years when motor cars will be running direct between Cleveland and Buffalo.

Escanaba, Mich.—The Escanaba Electric Railway Company, which has been reorganized will put the road into good condition and connect it at Wells with the Soo line. Additional cars will be purchased and sheds built. Parks and resorts will be made along the Escanaba river and it is expected in the near future the road will be extended to Gladstone.

Milwaukee, Wis.—Contracts have been let for the construction of the new power house of the Milwaukee Electric Railway & Light Company at River and Oneida streets, which will cost $600,000. It will be an ornamental and imposing structure of steel, stone and terra cotta.

New York.—It is officially stated that as soon as the Sixth and Eighth avenue roads are electrically equipped, the Metropolitan Street Railway Company will change its Broadway and Columbus avenue cable lines to underground trolley.

New Britain, Conn.—A comparison has been made covering five months with steam and five months with electricity between New Britain and Hartford. The steam road took in $135 a day, 750 passengers, while the third rail line took in $258 from 2,587 passengers per day.

New Brunswick, N. J.—The New York & Philadelphia Traction Company is making progress with its plan to extend its road from Bound Brook to Trenton. The company has secured franchises for the extension from Bound Brook to New Brunswick, where it will connect with the system of the Brunswick Traction Company. This will form part of the line to Trenton, the road branching off some distance from this city and going to Middlebush. Surveyors are now at work staking off the line from Bound Brook to Kingston. From Kingston it is the intention to proceed to Princeton and thence to Trenton. This will complete the system in Central New Jersey and be an important link in any trolley system crossing the State.

North Granville, N. Y.—There was a meeting in this place a few days ago in the interests of the proposed Whitehall-Granville electric railway. The object was to take the final steps towards procuring incorporation papers. Among those present were C. L. Baker of Troy, H. H. Burleigh, Judge T. A. Lillie and R. M. Witherbee of Whitehall, D. D. Woodard, president of the Granville National bank, Supervisor Norton of Granville, G. N. Finch and William Munson of that village. An adjournment was taken until August 16, when a meeting will be held at the law office of Potter & Lillie in Whitehall.

Quincy, Ill.—The electric street railway system was sold on the 5th inst. to a Maine syndicate represented by W. B. McKinley, of Chicago, for $220,000. The same syndicate controls street car systems and light plants in Joliet, Bay City, Champagne, Springfield, O; Trenton, Mo., and other cities. The syndicate will at once spend $100,000 for extension and rolling stock.

Richmond, Va.—An electric road between this city and Tappahannock is strongly advocated in the columns of the "Dispatch," which produces facts from a Tappahannock journal going to show that such a road is imperatively needed by the farmers and others living along the route and would be of great advantage to Richmond as well as to Tappahannock.

San Francisco.—It is probable that the Sutter Street Railway Company will soon acquire the Sutro electric line by purchase. The Sutro line was built for the sole purpose of forcing a 5-cent rate from the ferries to the Cliff, where Adolph Sutro had erected extensive pleasure grounds. The old lines refused to make the rate and Sutro was determined to force it in order to make his resort more popular and his property more valuable. It was stocked for $400,000 at $10 a share.

Sandusky, O.—The Cleveland capitalists, comprising the Sandusky & Interurban Electric Railway Company, who recently purchased the Sandusky Electric Railway have been inspecting the lines of the People's Company and Sandusky, Milan & Norwalk Company, with a view to their purchase if possible and the consolidation of the three Sandusky lines under one management before building the extensions east to Lorain and west to Toledo.

Steubenville, O.—An electric railway route is being surveyed between Steubenville and Mingo Junction. It is expected if the line is built to extend it to Toronto, O., and then to connect it with the Wellsville & East Liverpool Street Railway.

Toledo, O.—The "News" states that work on the Chicago, Detroit & Toledo Electric Railway will commence in a short time. The road was formerly called the Ohio & Michigan Traction, and the company was originally formed by Charles W. O'Brien, Leopold Freud and A. E. Riopelle, who procured right of way from the townships of Ecorse, Monguagon and Brownstown, in Wayne county, and Frenchtown, Erie, Lasalle and Monroe townships and the city of Monroe in Monroe county, Mich., as well as Washington township in Lucas county, O., and also connecting arrangements with the Toledo street railway system. The present company was organized about three months ago, and has the following officers: President, J. C. Shaffer, Chicago; vice-president, Leopold Freud, Detroit; secretary, Frederick S. Mordaunt, Chicago.

Waterville, Me.—It is reported that about $16,000 has been secured in subscriptions toward building the Waterville & Wiscasset Railroad, and that there would be little trouble in getting subscriptions enough to bring the total up to $50,000. Frank Redington of this city is president of the company.

Waynesboro, Pa.—The project for an electric railway for Waynesboro, which has been under consideration by a local syndicate for some months past, is now beginning to assume definite proportions. The scheme which will be, it is said, pushed ahead, is for a line to connect Waynesboro and the South Mountain resort system. Some months ago a company composed mainly of Baltimoreans was chartered under the name of the Blue Ridge Railway Company. Since the organization of this company the matter has been at a standstill until within the past week, when capital to the amount of several hundred thousand dollars is said to have been pledged.

Wilmington, Del.—It is confidently predicted by those in a position to know that within six weeks trolley cars will be running between Wilmington and Chester and Philadelphia. Rights of way under condemnation proceedings are being rapidly acquired in Delaware, and there appears to be no apprehension about any further obstacles.

MANUFACTURING, ETC.

Fort Wayne, Ind.—The Fort Wayne Electric Corporation has just sold to the lighting company at Montreal, Can., equipment for a 500 arc light plant.

Hoboken, N. J.—Plans have been prepared for an electric elevator on the inclined system for carrying cars and loaded trucks up the bluff just south of the West Shore Ferry at Weehawken. The structure will be about 300 feet long and the cost of the work and its electrical equipment will amount to $200,000.

Middletown, Conn.—The report is current here that Charles E. Dustin of Hartford, the former president of the Schuyler Electric Company, has subleased from the Worcester Cycle Company the Schuyler plant in Middletown, and that he will conduct an electrical business there.

New York.—Lewis Degen, an engineer for the General Electric Company, who has just returned from an extensive trip through Brazil, is reported in the "Journal of Commerce" as saying that the German electrical companies are acquiring a strong foothold in the Brazilian electrical field, for the reason that most of the business is transacted on time. In Rio de Janeiro the Siemens & Halske Company of Berlin has made some good contracts. American companies could secure more business in some of the South American countries if they cared to extend payments for their goods, but as it is, in transactions with this country, when they are direct, payment is required against bills of lading.

COMPANY MATTERS.

Jackson, Mich.—A decree has been entered in the Circuit Court here ordering the sale of the street railway by the Circuit Court commissioner, naming the time after August 31, to satisfy the mortgage held by the Fidelity Loan & Trust Company. The amount claimed is $171,829.50. The property has been in the hands of a receiver for the past year.

Pasadena, Cal.—The Edison Electric Company of Los Angeles has purchased the entire stock of the Pasadena Electric Light Company. About October 1 this company will begin furnishing power for itself and the Los Angeles Railway Company in Los Angeles and the Pasadena Electric Light & Power Company and the Pasadena & Los Angeles Electric Railway Company. The officers of the company are George H. Barker, president; William R. Staats, secretary; John B. Miller, treasurer.

NOTES FROM A CORRESPONDENT.

Amsterdam, N. Y.—The town board of the town of Florida has granted a request of De Witt A. Devendorf of Fort Hunter to string wires to convey the power from the electric plant at Mill Point to Amsterdam. The power will be used to run the electric cars in Amsterdam and also for electric light purposes.

Mechanicville, N. Y.—The Hudson River Power Transmission Company has started its plant at the new dam, with 2,000 horse power, 12,000 volts, and it will run continuously hereafter. Connection with the Edison works has been completed, and power to run that plant will be furnished from the power station at Furman Falls. Power for the street car line at Schenectady will also be furnished from Mechanicville.

Schenectady, N. Y.—Mr. F. O. Blackwell of the General Electric Company works delivered an address Thursday evening, August 11, before the Technical Association of this city. The subject of the lecture was "The Value of Water Power for Electrical Distribution of Power." It was well presented and was appreciated by all who were present.—A distinguished party of representatives of the Imperial Russian army and navy visited Schenectady, August 11. They visited the General Electric Company's works and were shown through the various departments.

Watervliet, N. Y.—The electric light commission has given to the Fort Wayne Electric Corporation the contract to construct two dynamos and to furnish the electric light plant with all the necessary appliances. The contract price is $4,220.

PERSONAL AND MISCELLANEA.

A letter from Rome states that electric light is about to be introduced into the 11,000 rooms of the Vatican. The plant is being set up in the former barracks of the French Guards.

For years past the West End Street Railway Company, Boston, has been in the habit of giving the mayor of Cambridge 6,000 free tickets to be distributed among the city churches as a contribution to the fresh-air fund. This year the Boston Elevated Railway Company, which has absorbed the West End, gave but 1,000 tickets, and the people want to know why a company that operates above the earth is less generous than a surface company.

Octave Thanet in a letter to the Denver "Republican" from Omaha, Neb., treating of the great Exposition now in progress there, says: "But the great feature of the Manufactures Building to the general public is the electric display. This is admittedly the finest ever made at any Exposition. No one can go through it without a sensation of awe before this vast, half-unfolded terrific force which we in our generation have made the slave of our daily life. It is a wonderful exhibit—and a terrible one."

Carl Moderegger, chief engineer for Siemens & Halske of Vienna, Austria, is visiting this country to make a close study of electric street railway systems. His company is working on an elevated electric railway system for Berlin, and has the contract for a new system in Vienna. St. Petersburg and Charlottenburg are also considering proposals from his company for electric railways. In carrying on the operations of his company on such a large scale it is necessary that they be in touch with the most advanced ideas, and to get these ideas is the secret of his visit to the United States.

Koran Sugahara, chief engineer of the Kobe Railway Company and of the Buso Chuo Railway Company, Japan, is a guest at the Hotel Duquesne, Pittsburg. He left Japan on the 8th of July and reached Pittsburg on the 1st inst. His purpose is to inspect 7,000 tons of steel rails the Carnegie Steel Company is making for his road. The "Dispatch" credits Mr. Sugahara with the following remarks: "There is no city in the United States so well known in Japan when iron and steel industries are considered as Pittsburg. Your city is particularly interesting to us as a people, for our energies are all directed to the development of our country by introducing everything that is best in invention and mechanical skill. Japan looks to the United States and England for models in everything she is striving to attain. All Japan's sympathies are with these countries, and she would like nothing better than an alliance with them."

Charles Poppe, an electrician employed by the underground trolley company operating the Lenox Avenue line, New York, on Tuesday last touched a live electric wire while at work in a conduit, and though 2,000 volts went through his body he is alive to tell the tale. Poppe was called to the conduit at 135th street and Lenox avenue during the afternoon to correct some defect. He climbed into the manhole and soon completed his task. While getting out he placed both hands on the channel rail and received the full force of the current. He was picked up apparently dead, but in a few minutes he revived, and beyond several serious burns on his hands, he seemed none the worse.

Dr. George B. Richmond, a mechanical genius who was accredited by some scientific journals with having invented the telephone, died at Lansing, Mich., on the 4th inst., at the age of 49. A dispatch from Lansing in the Detroit "News" announcing the death says: "Dr. Richmond applied for a patent a little later than the Bell people, but was, without doubt, prior to Bell in discovering the principle of the telephone. The Bell people were so greatly exercised over Dr. Richmond's application that they sent an agent here to purchase his patent, offering him $10,000 in cash and a permanent salary of $2,000 per year. He was dissuaded from accepting the offer by friends, who were to raise money to push his claims. They failed to do so and the claims went by default."

Electrical Engineer Peter Wintermuth in a letter from on board the U. S. cruiser New Orleans, published in "Leslie's Weekly," gives an idea of the duties of an electrician on a war vessel. He says: "On most ships-of-war the electricians stand their regular four-hour watches in the dynamo-rooms. We do not. The steam engineering department has charge, and it is our care to look after the circuits, the instruments, and make such repairs as are necessary. A complete test of the whole plant must be made each 'quarter,' and we have just finished our first one. The current is furnished by three thirty two kilowatt generators, direct connected to Armstrong compound generators. Their capacity is 400 amperes each. When it is considered that there are motor and searchlight circuits, and that the whole system needs constant attention, it may be seen that much work is necessary to keep the system in working order. The main battery, consisting of the guns, is provided with electric firing devices and miniature incandescent lamps for night sights. This power is furnished by batteries, and beyond testing twice each day they do not require much attention. A correct and complete log must be kept daily. This includes the reading each hour of the steam pressure, engine speed, voltage and current on the generators, with any remarks as to the general working of the system during each twenty-four hours. All materials expended from the electrical store-room must be carefully accounted for. When at sea in the enemy's country a man must sleep on each fighting top for possible operation of the searchlights, of which we carry four. Our work is, of course, harder some days than others. Altogether, an electrician's position is far from being a snap. There is much disagreeable work, and it seems to a new man that the officers have unpleasant ways of saying things."

RECENT COMPANY ELECTIONS.

Laconia & Lakeport Street Railway Company, Laconia, N. H.—President, Harry L. Pierce; treasurer, Charles T. Foster; clerk, Edmund Little; directors: Harry L. Pierce, Charles T. Foster, Leominster, Mass.; George H. Cooke, Athol, Mass.; Samuel B. Smith, Edmund Little, Albert G. Folsom, Laconia, and Alpha J. Pillsbury, Tilton, N. H.

Pittsfield Electric Company, Pittsfield, Mass.—President, Alexander Kennedy; manager, W. A. Whittlesey; assistant manager, W. R. Gardner; treasurer, W. A. Whittlesey; clerk, W. L. Adam; directors: W. R. Plunkett, Alexander Kennedy, C. E. Merrill, W. L. Adam, James W. Hull, W. A. Whittlesey and H. R. Peirson.

Escanaba Electric Railway Company (reorganized), Escanaba, Mich.—President and manager, A. R. Moore; vice-president, O. B. Fuller; secretary, I. C. Jennings; treasurer, Edward Erickson; directors: J. B. Moran, A. R. Moore, J. K. Stack, M. H. Grover, Edward Erickson.

Standard Electric Heat, Light & Power Company, Avoca, Pa.—President, ex Congressman Jordan, of Tunkhannock; directors: A. H. Squiers, E. T. Squiers, Frank Tergler and Leon Schrager.

INCORPORATIONS.

The Eastern Townships Light, Power & Carbide Company, North Hatley, Can.—to supply electric light to the villages of Waterville, Eustis and North Hatley, and also to manufacture calcium carbide. Capital stock, $50,000. The company has purchased the entire plant formerly owned by Edgar & Roy and propose to extend the business.

The Mexico City Light, Heat & Power Company, New York. Capital stock authorized, $5,000,000; subscribed, $500; paid in, $50. Incorporators: Andrew L. Conary, Frank Johnson, William C. Foster, Frederick Giblin, New York City.

The Esmond Electric Traction & Signal Company, New York City. Capital stock authorized, $5,000,000; subscribed, $500; paid in, $100. Incorporators: David M. Maxon, Charles S. Jones, David A. Davies, Brooklyn, N.Y.; R. H. E. Starr, George E. Cruse, New York City.

The Mason Electric Light Company, Mason, Mason County, Tex.—to supply electric light. Capital stock, $5,000. Incorporators: L. Gugenheim, V. M. Loring, John Lemberg, Otto Donop and Richard Grosse.

The Mattoon Heat, Light & Power Company, Mattoon, Ill.—to supply electric light and hot water heating. Capital stock, $52,000. Directors: C. E. Wilson, Louis Katz, J. F. Marks, Allan McFall, J. A. Montague, G. G. McCamant, E. E. Somerville. The company has a 25-year franchise to operate in Mattoon.

The Brodhead Contracting Company, Newark, N. J.—to build railroads of all kinds, canals, reservoirs, waterworks, bridges, telephone, telegraph and electric light lines and plants, and to build, purchase and sell vessels, warehouses, etc., buy land, and deal in mortgages, bonds, stocks and all kinds of securities. Capital stock, $125,000, business to begin on $1,000. Incorporators: James E. Brodhead, of Flemington; Charles Holzhauer, of Newark; Calvin E. Brodhead, Jr., of Perth Amboy; Andrew D. Brodhead and Frederic J. Foulks, of Elizabeth, N. J.

The Berlin Electric Light Company, Berlin, Somerset County, Pa. Capital stock, $4,000. Directors: W. S. Matthews, Berlin; J. A. Berkey, G. B. Hugh, J. M. Bricker, H. F. Barron, Somerset.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 9, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

608,723. Electric-Arc Lamp. Thomas Spencer, Philadelphia, Pa. Filed Sept. 29, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

608,685. Lightning-Arrester. John F. Kelly, Pittsfield, Mass., assignor of one-half to Cummings C. Chesney, same place. Filed Dec. 16, 1895.

608,711. Electric Motor. William H. Powell, Erie, Pa., assignor to the Keystone Electric Company of Pennsylvania. Filed Nov. 4, 1897.

608,721. Automatic Electric Regulator. Robert Skeen, St. Louis, Mo. Filed Oct. 23, 1897.

608,755. Apparatus for Storing and Using Solar Heat. Henry F. Cottle, Boston, Mass., assignor of two-thirds to William Calver, Washington, D. C., and John J. Pratt, Revere, Mass. Filed Dec. 11, 1897.

608,842. Electric Meter and Motor. Harry P. Davis, Pittsburg, and Frank Conrad, Wilkinsburg, Pa., assignors to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed June 18, 1898.

608,878. Switch for Varying Electrical Resistance. Eduard F. H. H. Lauckert, London, England, assignor to Siemens Brothers & Co., Limited, same place. Filed Nov. 29, 1897.

608,895, 608,896. Generator for Electrical Igniters. Benjamin McInnerney, Omaha, Neb., assignor to the McInnerney Manufacturing Company, same place. Filed March 30, 1898.

608,952. Electrical Cooking Apparatus. John B. Carv, Baltimore, Md., assignor of one-half to Marie Clothilde Delavy, same place. Filed March 14, 1898.

ELECTRIC ELEVATORS.

608,789. Elevator. Charles H. Newhall, Providence, R. I., assignor of one-half to James A. McCoart, same place. Filed Dec. 9, 1896.

TELEPHONE AND TELEGRAPH APPARATUS.

608,846. Telegraph-Repeater. Henry P. Donnelly, Cincinnati, O. Filed June 23, 1897.

608,932. Telegraphy. George V. Trott, Chicago, Ill., assignor of one-half to Ella M. Cozens, same place. Filed Aug. 13, 1897.

MISCELLANEOUS.

608,614. Plate for Secondary Galvanic Batteries and Composition for Producing Same. Carl Marschner, Berlin, Germany. Filed Sept. 30, 1896.

608,637. Supporting-Clip for Overhead Electric Conductors. William A. Bartley, Boston, Mass. Filed May 23, 1898.

608,714. Storage Battery. John D. Rively, Pittsburg, Pa. Filed June 9, 1897.

608,768. Electrodynamic Apparatus for Operating Clipping, Brushing or Other Mechanisms. Warren P. Freeman, New York City, assignor to Robert J. Campbell, same place, and Francis Larkin, Jr., Sing Sing, N. Y. Filed Aug. 12, 1897.

608,906. Insulation of Electric Wires. Joseph A. Poche, New Orleans, La. Filed June 22, 1898.

608,911. Electric Cable. Henry A. Reed, Newark, N. J. Filed Oct. 24, 1896.

608,928. Apparatus for Heating Air for Therapeutic or Other Purposes. William Taylor, Edinburgh, Scotland. Filed Dec. 21, 1897.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

TELEPHONE AND TELEGRAPH.

A Detroit paper says: "Michigan farmers are taking kindly to the telephone, and it is probably but a matter of a few years when the telephone will be as common in the country as it is in the cities now. In Allegan county the farmers have an exchange of their own and they maintain it by annual assessments. The line runs from Holland, through Saugatuck, Ganges, Douglass and Fennville to South Haven, and it is used chiefly during the fruit season to facilitate the handling of berries and peaches. About 130 farmers and fruit growers built the line and maintain it, and the annual assessment upon each is about $10. Every township in Oceana county has telephone connections with Hart, the county seat, and this system is essentially a farmers' exchange, and is owned and maintained chiefly by the farmers and fruit growers. The Oceana county system, as also the Allegan county fruit growers' line, are being connected with a State exchange, and before the peach system fairly opens the farmers in both sections will be in easy talking range of the commission and railroad men here and the steamboat men at the lake ports. Gratiot county has another farmers' exchange which, with Ithaca as the center, has connections with every township and many farmers. The system gives free service throughout the county to its subscribers and will soon be connected with the outer world. It is a great advantage to the farmers in marketing their products."

A veritable network of telephone wires, says the Sioux City *Times*, will soon cover northwestern Iowa and the country in Iowa, Nebraska and South Dakota around Sioux City. In addition to the numerous toll lines which already radiate in every direction from Sioux City, the independent companies and the Bell companies now are engaged in building extensions which will cost about $100,000. W. A. Houts, a banker of Parker, S. D., and W. W. Prichard, of Spirit Lake, each a large promoter of independent lines, met in Sioux City a few days ago and conferred regarding the work of construction. Mr. Prichard has just completed his line from Sheldon to Cherokee, and is building from Cherokee to Remsen. The material for the Houts line from Sioux City to Remsen, where it will connect with the Prichard system, is on the ground. This line will be built by way of Le Mars, and a branch line will extend north from Le Mars to Sheldon, running through Dalton, Seney, Struble, Alton, Orange City and Sioux Center. Mr. Houts also will run a line west from Orange City to Hawarden. Mr. Prichard will extend his lines east from Cherokee along the line of the Illinois Central to Storm Lake, and along the Chicago and Northwestern from Sutherland to Laurens. The material for these extensions is being delivered.

The Alaska Telegraph & Telephone Company, composed of prominent San Francisco capitalists, have succeeded in securing a franchise from the Canadian Government granting them the right to construct, operate and maintain telegraph and telephone lines in Canadian territory over the Chilkoot Pass, running along the lakes and up the Lewis and Yukon rivers to Dawson City. The line will begin at Juneau, Alaska, and from there will run in a northerly direction to the town of Dyea, thence in a northeasterly direction over the Chilkoot Pass. It will then follow the line of the Lewis and Yukon rivers to Dawson City, and from there on to Circle City, where it will terminate. The company was incorporated in San Francisco in July, 1897, for $250,000. The officers of the company are Theodore Reichert, president, and J. F. Fassett, secretary. The present directors are: I. J. Truman, of the Columbian Banking Company; Theodore Reichert, late Surveyor General of California; D. E. Bohannan, George T. Gaden and J. F. Fassatt.

Rival telephone companies are about to clash in the Monongahela Valley, Pa. The Bell Company has had a monopoly in this territory, but the Maryland, Pennsylvania & West Virginia Company is now making strong competition. The latter has established exchanges at Uniontown and Connellsville, and is putting in an exchange at Masontown. The new company has purchased private lines to Farmington and Masontown from Uniontown, and is hustling to secure the right of way to Brownsville and on down the Monongahela.

The annual report of the Kansas Labor Commissioner states that there are 16 local telephone companies in Kansas operating successfully. A bitter war is now being waged between the local companies and the Missouri & Kansas Company, the Bell licensee. Commissioner Johnson anticipates that all the first and second class cities in Kansas will have their own local companies in a few years, and that a company will be formed to couple the local companies together with long distance wires.

The National Fire and Police Telegraph Superintendents' and City Electricians' Association, which held its annual meeting at Elmira last week, closed its sessions on the 11th inst., after electing officers and deciding to hold its next national convention in Wilmington, Del. The officers elected are: President, Jonathan W. Aydon, Wilmington, Del.; vice-president, C. T. MacDonald, Ottawa, Canada; treasurer, Adam Boesch, Newark, N. J.; secretary, H. T. Blackwell, Jr., New York; financial secretary, Burt McAllister, Bradford, Pa.

The Des Moines (Ia.) *News* states that the plan of the Central Telephone Company of uniting several of the smaller independent toll lines into one company has met with marked success. Already they have control of several different lines running into Des Moines and are now looking forward to a consolidation of probably the Boone or Marshall County Telephone Company. These are considered the strongest of the independent organizations.

The Sacramento (Cal.) *Bee* says: "The Western Union and Postal Telegraph Companies and the Wells-Fargo Express Company are not the only corporations doing business in Sacramento that have avoided the war tax. There is the Pacific Telephone & Telegraph Company, otherwise known as the Sunset Telephone Company, which has not only saddled its share of the war tax upon the people, but has actually profited through the enactment of the War Revenue bill."

The People's Telephone Company, which expected confidently to get a telephone franchise in Windsor, Ont., has become disgusted with the shuffling action of the council and dropped out of the contest. The local Bell company appears to have a strong political "pull" with the present council, and the People's Company has decided to wait until a new council in more accord with the sentiments of the people on the telephone question is elected.

The directors of the Tidewater Telephone Company met at Gloucester Court House, Va., on the 5th inst., and in addition to transacting routine business declared a 5 per cent. dividend. This company started in 1888 with about 100 miles of wire and 17 telephones, which were rented. It now has 266 miles of wire and 76 stations.

The New York & New Jersey Telephone Company is extending its line to the army camp at Montauk Point, Long Island. Several circuits will be laid and some of them are already completed. An exchange will be erected and expert operators placed in attendance. Special rates will be given to soldiers and to any one talking with soldiers.

Dock Jarvis of Hubbard and Tice Moreland of Rienzi, have been canvassing for subscriptions for a proposed telephone line from Hillsboro, Hill county, Tex., to Hubbard and Mount Calm, and have met with much success. The line will connect Hillsboro with Massey, Zeevee, Rienzi, Irene, Hubbard and Mount Calm.

M. F. Thompson and Walter Stuart of Carlisle, J. L. Shelly of Mechanicsburg, W. B. Oyler of Newville, and R. W. Hockersmith of Shippensburg have applied for a charter for the Southern Pennsylvania Telephone Company to operate lines in the southern counties of Pennsylvania.

A charter has been granted to the Liberty & Central Telephone Company of Liberty, S. C. The officers of the company are: President and general manager, T. N. Hunter; secretary and treasurer, H. L. Clayton.

It is announced from Rockwood, Mich., that the People's Telephone Company of Wayne and Monroe counties will extend its line next to Scofield, Maybee and Monroe.

New Companies Incorporated.

The American Telephone Directory Company, Pittsburg, Pa. Capital stock, $10,000; amount subscribed, $1,000 amount paid in, $100.

The Quaker City Telephone Company, Quaker City, Ohio. Capital stock, $500.

The Winchester & Lexington Telephone Company, Winchester, Ky. Capital stock, $1,650.

The Warren Telephone & Telegraph Company, Warren, Pa. Capital stock authorized, $25,000; subscribed, $500; paid in, $50. Incorporators: Geo. O. Chilton, E. K. Reedy, E. M. Estell, P. C. Russell, D. J. Keefe, Charleston, W. Va.

The Union Telephone & Telegraph Company, Erie, Pa. Capital stock authorized, $1,000,000; subscribed, $500; paid in, $50. Incorporators: Geo. O. Chilton, E. K. Reedy, E. M. Estell, P. C. Russell, D. J. Keefe, Charleston, W. Va.

The Moral Telephone Company, Moral, Okl.—to build and operate a line from Moral to Tecumseh, Lexington and Purcell. Capital stock, $2,000. President, J. M. Lamm; secretary, J. R. Lamm; treasurer, L. P. R. Miller.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N Y.—Aug 15.						
Albany Ry. Co	100	2,000,000	$1,750,000	1½ % Q., Feb. '98.	145	150
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	69	70
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown, Pa.—Aug 15:						
Allentown & Lehigh Val. Trac. Co.	..	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Aug. 15:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	85	..
Baltimore, Md.—Aug 15:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	..	72½
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23⅛	23⅜
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—Aug 15:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	...	..
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	10¼	12
North Shore Traction Co.......pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	76	78
b West End Street Ry. Co.......com.	50	10,000,000	9,085,000	1 % S., Oct., '97.	87⅜	87½
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	...	105½
Boston Elevated R. R.	100	10,000,000			66¾	67
Brooklyn N. Y.—Aug 15:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	67	67⅛
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	214	214¼
‖eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	210	..
Kings County Elevated	....	4,750,000	4,750,000	....	2½	6
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	..	...
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Aug 15:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	....	55	60
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	80	81
Columbus O.—Aug 15:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	49	50
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Aug 15:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Aug 15:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	275	280
Chicago & South Side R. T. RR	100	10,823,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	18	18¼
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	2
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan., 98.	212	218
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	98½	91
jChicago West Div. Ry.......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Aug 15:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	8,500,000	....	23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	114¼	114½
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Aug 15:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	37	39
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '97.	62½	63
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	60	61
Detroit, Mich.—Aug 15:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	..	100
Detroit Electric Railway	....	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Aug 15:						
City Railway Co.............com.	100	1,500,000	1,470,600	1¼ % Q., Jan.1,'98.	100	102
City Railway Co.............pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	150	155
People's Street Railway	....	1,100,000	....	....	100	..

* Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
b Leased to Boston Elevated Railroad Company.
c Owned by Brooklyn Rapid Transit Company.
d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.
e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR
g Owned by Atlantic Ave. RR. and leased to Nassau system.
h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.
i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.
k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Aug 15:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	--
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	--
Holyoke Mass.—Aug 15:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—Aug 15:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	--
Indianapolis, Ind—Aug 15.						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	27	30
Lancaster, Pa.—Aug 15:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	..
Lancaster & Col. Electric Ry	....	....	87,500	....	..	..
West End Street Railway	...	....	....	....	..	..
Louisville, Ky.—Aug 15:						
Louisville Ry.......................com	100	4,000,000	3,500,000	1¼ %., Oct., '97.	34	39
Louisville Ry...............5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97	96	100
Minneapolis, Minn.—Aug 15						
Twin City Rapid Transit.........com	100	17,000,000	15,010,000	....	18	23
Twin City Rapid Transit....7 % pfd.	...	8,000,000	1,714,200	1¾ % Jan., '98.	..	100
Montreal, Canada.—Aug 15:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	274½	276
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¼ % S., J. & J.	99½	100¼
Memphis, Tenn.—Aug 15:						
Memphis Street Railway Co	100	500,000	500,000	....	15	--
New Haven, Conn.—Aug 15:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—Aug 15:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	146	170
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co.......com.	100	5,000,000	5,000,000	....	1½	2
New Orleans Traction Co........pfd.	100	2,500,000	2,500,000	....	6½	8¼
aCrescent City RR...............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	32
bNew Or. City & Lake RR.....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	85	88
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	18	22
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	53	54½
New York—Aug 15.						
Central Crosstown RR	100	600,000	600,000	2½ % Q., July, '97.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Jan., '98.	150	160
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98.	170	190
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Jan., 98.	158½	159
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	32	34
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	210	220
gCen. Park, N.&E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98.	180	..
hEighth Avenue RR	100	1,000,000	1,000,000	....	320	..
i42d St. & Grand St. Ferry RR.guar	100	750,000	748,000	4½ % Q., Feb., '98.	340	..
jNinth Avenue RR..........guar.	100	800,000	800,000	....	170	180
kSixth Avenue RR...............guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q. Feb., '98.	330	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., Jan., '98.	178	181
Third Avenue RR	100	12,000,000	10,000,000	2 % Q., Feb., '98.	175	178
m42d St., Manhatv'le & St.Nich.Av	100	2,500,000	2,500,000	....	58	62
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Aug 15:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	51	51¼
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¼ % A.	195	205
Pittsburg, Pa.—Aug 15:						
Allegheny Traction Co	50	500,000	500,000	....	...	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	16	16⅛
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	52⅜	52¼
pCentral Traction Co	50	1,500,000	‡900,000	....	..	...
qCitizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	62⅜	...
rDuquesne Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	..	...
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	24½
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	‖2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	2[illegible]	22
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 97	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	300,000	200,000	....	..	..

* Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.
b Leased to New Orleans Traction Company at 8 % on stock.
c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.
d Operating the former Met. Trac. system, that corporation having become extinct.
e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.
i Leased to Metropolitan Street Railway for 18 % on stock.
j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
k Leased to Metropolitan Street Railway for $145,000 per annum.
l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
m Controlled by Third Avenue Railroad by purchase.
n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.
o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co
p Leased to Consolidated Traction Company for 8 % per annum on par value of stock
q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.
r Leased to Consolidated Traction Company for 4 % on capital stock after October,
s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Aug 15						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	158
Northampton, Mass—Aug 15						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	168	175
Omaha, Neb.—Aug 15:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Aug 15:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	85	86
Providence, R. I.—Aug 15:						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	60	64
Philadelphia.—Aug 15:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	43½	45
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98.	65½	66
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	65	66
Union Traction Co ... $12½ pd	50	30,000,000	29,930,450	....	20⅝	20¾
eElectric Traction Co	50	....	8,297,920	....	71⅛	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	390	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	256	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135½	..
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct 1, '97.	91	91⅛
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	142½	..
jEmpire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	175	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90¼	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	288	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	275	...
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.—Aug 15:						
Rochester Railway Co	100	5,000,000	5,000,000	....	9	12
Reading, Pa.—Aug 15:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	64	..
St. Louis Mo.—Aug 15:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % July, '98.	125	127
National Railway Co	..	2,500,000	2,479,000	1½ %, July, '98.	..	—
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '98.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	800,000	50c., Dec., '89.	..	..
Southern Electric Ry...com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	110	112
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	54	56
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Aug.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	107	108
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅝	53¾
Presidio & Ferries RR	100	1,000,000	550,000	....	...	8½
Scranton, Pa—Aug 15:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
m Scranton & Carbondale Trac. Co.	100	500,000	500,000	....	..	18
m Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Aug 15:						
Springfield Consolidated Ry	100	750,000	750,000	....	—	11
Springfield O.—Aug 15:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—Aug 15:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—Aug 15:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	99½	100½
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	274½	276
Washington, D. C.—Aug 15:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	73⅛	75
Columbia Ry. Co	50	400,000	400,000	6 % A.	76½	78
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	121	123
Worcester, Mass.—Aug 15:						
*Worcester Traction Co...com.	100	8,000,000	8,000,000	....	15	17
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	91½	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Aug 15:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
f Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 15:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., July, '98.	283	284½
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	73	..
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Feb. '98.	142	..
New York.—Aug 15:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	95½	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1¾ % Q.	104	105½
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	180	185
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	..
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan.., '98.	73	..
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	112	115
*International Ocean Tel Co. guar 6%	100	8,000,000	......	1½ % Q.	107	110
Mexican Telephone Co	100	2,000,000	......		.59½	.75
*New York & New Jersey Tel. Co.	100	5,000,000	8,723,000	1½ % Q., Jan., '98.	149	150½
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	78	77
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co. guar. 5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union Telegraph Co	25	500,000	500,000	8 % S., Jan. 1 '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	93⅞	98½
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Aug 15:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	165	170
Chesapeake & Potomac Telep. Co.	100	......	......	....	48	..
Chicago Telephone Co	100	......	......	......	202	..
Central Dist Prtg & Telg. Co. (Pgh.).	100	750,000	750,000	....	..	..
Empire & Bay States Telegraph Co.	...	......	......	....	70	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	76	77
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	110	115
Providence (R. I.) Teleph. Co	50	....	......	....	85	86½
Southern New Eng. Teleph. Co	100	8,000,000	......	....	119	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 15:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
General Electric Co...com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	41	41⅜
General Electric Co...pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	95	100
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	8
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	....	30¼	31
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., July, '98.	58	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Aug 15:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,938,000	....	133	131¼
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '97.	122½	123½
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	21	23
General Electric Co...com.	100	40,000,000	30,460,000	2 % Q., Aug, 1898.	41	41⅜
General Electric Co...pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	95	100
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co...pfd	..	......	......	....	..	..
Pittsburg, Pa.—Aug 15:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	180	140
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Aug 15:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	83½	84
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	40	41
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$32500 dis. Jan. 11'97	18½	14
Southern Elec. Light & Power Co.	10	187,500	187,500	....	8	10
Miscellaneous.—Aug 15:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	40	..
Missouri-Edison (St. Louis)....com.	..	......	......	....	15	18
Eddy Electric Mfg. Co	25	......	......	....	—	18
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	115	125
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	4	7
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	160	170
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	81	87
Rhode Island Elec. Protec. Co	100	......	......	....	110	120
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q	*158	158½
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	136¼	137
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	.....	......	....	100	110

*ex d.

ALLIED INDUSTRIES.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Aug 15:						
American Electric Heating Co	50	10,000,000	....	....	.05	.07
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb. 1, '98	35	37
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—Aug 15:						
Consolidated Electric Storage Co	...	......	....	....	18	20
Edison European	..	......	....	.....	1	3
Safety Car Heating & Lighting Co.	100	......	....	......	..	98½
Worthington Pump Co....com.	100	5,500,000	5,500,000	......	80	88
Worthington Pump Co....pfd	100	2,000,000	2,000,000	7 %	90	92
Philadelphia, Pa.—Aug 15:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1	1½
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	18	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	70	..
Welsbach Light Co	5	525,100	......	....	50½	51½
Welsbach Light Co., Canada.	5	500,000	......	....	1½	1¾
Pittsburg, Pa.—Aug 15:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	109	110
Miscellaneous.—Aug 15:						
*Barney & Smith Car Co.....com.	100	......	1,000,000	....	..	15
*Barney & Smith Car Co......pfd.	100	......	2,500,000	2 %	...	65
Billings & Spencer Co	25	......	......	....	30	37
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	30	35
Johns-Pratt Co	100	......	......	....	..	97
*Pratt & Whitney Co.........com.	100	......	......	....	..	10
*Pratt & Whitney Co.........pfd	100	......	......	....	45	52
Stillwell-Bierce Co.........com.	..	......	......	....	96	98
Stillwell-Bierce Co.........pfd.	..	......	......	2 % Sept. 1, '97.	107	109
Shultz Belting Co	100	500,000	......	....	60	[illegible]
St. Charles Car Co	..	......	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Aug 15, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR.1st mtg. 6s	350,000	350,000	1919	M. & N.	*118½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..................1st 5s	....	....	......	......	*105	105½

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Aug 15, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113½	114
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	113½	114
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103½	104
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116½
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	102¼	102¾
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	116	117
City & Suburban Ry......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	114	......
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	....
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	118	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	105
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M.& N.	104	105
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry...........1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¼	102¼
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry......1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	103½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	54	54¾
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	104	104¼
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	104½	....
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	99¼	99⅞
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	94
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Aug 15, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	102	102½
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	108
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108½
So. Cov. & Cin. St. Ry........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‖So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	102	102½
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102	105
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry.................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1913	M. & S.	106	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. [illegible]	100,000	94,000	1909	M. & S.	102	......

*With interest. *Unlisted.

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	101	....
Crescent City RR.............1st mtg. 6s.	......	50,000	1899	M. & N.	100¼	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	76	79
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	105	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100¼	101¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	110	....
Orleans Railroad Co.......Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	101½	....
‡St. Charles St. RR. Co......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	104¼	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105	110½
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	107	110
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	110	112
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface............2d mtg. 5s.	1,000,000	1,000,000	1905	......	104	105¼
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	114½
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	113	114
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	103	....
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit..........gold 5s.	7,000,000	5,181,000	1945	....	104¼	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	101	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	111½
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118½	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115¾	116½
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	*102
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	...
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	118	116
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	95
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	121	122
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	114	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	107	109
Second Avenue Ry...............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	113½	114
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123	125
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	...
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	112½	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	109	......

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	...

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—Aug 15, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.......................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	..
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	102	103
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,800,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...................Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	.....
West End Passenger Ry.........1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	...
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	89	......
Central Traction Co...............1st mtg. 5s.	375,000	375,000	1930	J. & J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	105½	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	105	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	....	105
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co....................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	...

Providence R. I.

Date of Quotation— Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.	......	.....
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation—Aug 15, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	100½	101½
Cass Ave. & Fair Gds. Ry.......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	101½	102½
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1918	J. & J.	111	112½

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis. *Date of Quotation—Aug 15, 1898.*						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	$50,000	$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.......................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	106⅛	107⅛
Missouri RR. Co...........................	1,000,000	700,000	1916	M. & S.	106	107
‡Mound City RR. Co..............1st mtg. 6s.	400,000	300,000	1910	A. & O.	101	103
People's RR. Co.....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co......................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97⅛	100
People's RR. Co...............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100⅛	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101⅛	102⅛
St. Louis & Sub. Ry......................Income 5s.	300,000	300,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
†Taylor Avenue St. Ry.......1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110½	111⅛
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102⅛	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co. ‡Controlled by Union Depot RR. Co. §Controlled by Lindell RR. Co. ‖$200,000 in escrow to retire 1st & 2d mtg. §$600,000 in escrow. ††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal. *Date of Quotation—Aug, 1898.*						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114¾	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	118⅛	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	92⅛	97⅛
Market St. Cable Ry. Co....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	126	....
†Metropolitan Ry. Co.................1st mtg.	200,000	....	....	....	......	......
†Omnibus Cable Co..................1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	124½	......
†Park & Cliff House RR.........1st mtg. 6s.	350,000	350,000	1912	J. & J.	109	......
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	88½	110
†Powell St. Ry.........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118½	120
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109¾	110
†Controlled by Market St. Ry. Co.						
Washington D. C. *Date of Quotation—Aug 15, 1898.*						
Belt Ry. Co..........................Cons mtg 5s.	500,000	450,000	1920	J. & J.	33	....
Columbia Ry.............................. mtg. 6s.	500,000	500,000	1914	A. & O.	118	122
Eckington & Soldiers' Home.... mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll tr. cons. 6s	500,000	500,000	1901	J. & J.	118	119⅛
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous. *Date of Quotation—Aug 15. 1898.*						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co.......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	111	112⅛
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	108⅛	110
§Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	101	102
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	103¼	105⅛
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	101⅛
Denver City Cable Ry..........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	79
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	118	114⅛
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	1,050,000	1919	J. & J.	90	93
†‡No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	3,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108⅛
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	96	....
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92⅛
†$1,000,000 in escrow to retire 1st and 2d mtg. bds. ‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co. §$760,000 in escrow to retire bonds of C. C. St. RR. Co. ‖$87,000 in treasury. §$960,000 res'ved to redeem prior liens. ††$620,000 in escrow.						
						*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass. *Date of Quotation—Aug 15, 1898.*						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	106⅛	....
Pittsburg, Pa. *Date of Quotation—Aug 15, 1898*						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s	195,570	......	......	M. & S.	......	......
Miscellaneous.—(Aug 15, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,812,000	1910	......	110	....
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	....	117⅛	....
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	....	......
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	....	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	......

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation—Aug 15, 1898.*						
American Bell Telephone..................7s.			1898	F. & A.	100	....
Northwestern Telegraph Co...............7s.	....	......	......	......	....	....
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	......	......	106	....
Chesapeake & Potomac Teleph. Co...5s.	......	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation—Aug 15, 1898.*						
American Electric Heating...........5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co.	....	....	....	......	......	25
Barney & Smith Car Co.....................†6s	....	....	1942	J. & J.	97	100
Carborundum Mfg. Co.......................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co......................	75,000	....	......		[illegible]	[illegible]

*U Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11¾c.; Lake, 11¾@12c.; casting, 11½@11⅝c.

The Redlands (Cal.) Electric Light & Power Company has filed a certificate of an increase of capital stock from $200,000 to $500,000.

The Third Avenue Railroad Company, New York, has declared a quarterly dividend of $2 per share, payable August 31. Transfer books close August 19 and reopen September 1.

The receivers of the Saginaw (Mich.) Street Railway have been authorized to issue $33,000 worth of additional certificates to be used in paying city taxes and building new track.

Bridge Commissioner Shea has practically decided to grant the application of the Brooklyn trolley companies for two additional loops on the bridge structure so as to relieve the traffic congestion on the New York end.

The State Railroad Commission has approved the petition of the Metropolitan Street Railway Company of New York to increase its capital stock from $30,000,000 to $45,000,000. Of the $15,000,000 increase $10,000,000 will be sold at par to stockholders at once and $5,000,000 will remain in the treasury.

The annual report of the Boston Electric Light Company for the year ended June 30, 1898, shows gross earnings of $809,943, against $759,643 the previous year; expenses $513,409, against $485,498; net $296,534, against $274,145; interest charges $70,393, against $63,242; net for stock $233,453, including $7,312 premium on stock sold, against $218,644, including $7,742 premium on bonds sold; dividends $102,000, against $110,500; surplus $131,453, against $108,144.

Superintendent of Lamps Donovan's annual report shows that Boston's street lighting expenses for the past fiscal year were $619,697.80. The total appropriation was $620,000. The salary list was $8,434.34, or only about 1⅓ per cent. of the expenditures. The total number of lamps was 13,577, of which 3,007 were in Dorchester, 2,734 in the city proper, 2,338 in West Roxbury, 2,019 in Roxbury, 1,061 in South Boston, 986 in Brighton, 738 in East Boston and 692 in Charlestown.

At a meeting of the bondholders of the Terre Haute (Ind.) Street Railway Company, at which bonds to the amount of $372,000 out of a total issue of $400,000 were represented, a resolution was passed constituting William H. Henkle, Moses L. Scudder and Demas Deming a committee to take charge in connection with the trustees of the interest of the bondholders and to have all the bonds deposited under a proper agreement. William H. Henkle, secretary of the Illinois Trust & Savings Bank, was appointed chairman of the committee.

A decision recently rendered by the Japanese Patent Bureau is of great importance to American inventors, as it decides that no foreign patent which has had prior registration in another country can be registered in Japan. This would seem to show that the protection supposed to be enjoyed by American and other foreign inventors under existing treaties does not exist, as the provisions of these treaties are wholly inapplicable to the patents already in existence, any of which can still be pirated in Japan.

The board of freeholders of Union County, N. J., on Monday evening granted a franchise to ex-Congressman John Kean for a trolley road between Elizabeth and Plainfield for $250,000. The county will spend the money to widen the county boulevard to 100 feet, making two wagon roadways and two bicycle paths for the entire distance of twelve miles. In addition to the quarter of a million dollars in cash, ex-Congressman Kean agrees to pay 4 per cent. interest on any amount in excess of that figure it costs to complete the boulevard improvement.

Announcement was officially made on the floor of the New York Stock Exchange on the 11th inst. that the Westinghouse Electric & Manufacturing Company had arranged for the issuance of $3,500,000 worth of gold debenture certificates, the proceeds to be used in paying off the floating debts of the concern. The bonds will run fifteen years and will bear 5 per cent. interest. Only $3,000,000 of the issue will be sold. These certificates will be placed without creating any mortgage on the company's assets. It is further agreed not to create any lien on the company's property. The new issue will, it is said, enable the return to the treasury as available assets stocks and bonds in various lighting and power companies associated with the Westinghouse concern, yielding an annual income exceeding one-half of the interest charges of the certificates.

A press dispatch from Chicago states that "the promoters of the movement looking to the consolidation under one management of the surface and elevated traction companies of Chicago are busy on their scheme and believe they have a better chance of succeeding than they had two weeks ago. Two obstacles are to be met and mastered before success is assured. The financing of the scheme has ceased to be a worry. The Manhattan Trust, Elkins & Widener, and certain Sugar and Standard Oil interests will care for that. The chief difficulty lies in securing the control of the Chicago City Railway Company. It pays 12 per cent. annually on its $12,000,000 of capital, is conservatively managed, and its stockholders are inclined to hold on to their stock." A later dispatch states that in a few days the details of the consolidation of the street car systems will be perfected. The consolidation was brought about chiefly, it is stated, through the efforts of Joseph Leiter, who is one of the principal stockholders of the Chicago City Railway Company. The arrangement is based upon the conversion of stock of that company into bonds of the consolidated corporation on a ratio that will give the stockholders of the City Railway Company a net profit of nearly $4,000,000.

Mayor Phelan has vetoed the resolution of the Board of Supervisors of San Francisco awarding the contract to the San Francisco Gas & Electric Company for lighting the city streets for two years. In closing his veto message, the Mayor says: "By the refusal of the board to grant to the Mutual Electric Light Company the same privilege enjoyed by their competitor the city will have plainly lost in two years $60,000 if this proposed contract stands. The Mutual Electric Light Company, however, has not accepted the action of the board as final, because it forthwith sued out a writ of mandamus to compel the board to grant it the privilege asked. On June 17 last the case was argued before Judge Sewall of the Superior Court and now awaits his decision. Should the court decide that the board had no right to refuse the privilege asked by the Mutual Electric Light Company and this contract be awarded now to the San Francisco Gas & Electric Company, the relief sought by the competing company would be futile and the city at the same time be deprived of the opportunity of making a more advantageous contract."

The semi-annual statement of the United Electric Securities Company, Boston, for the year ending August 1, compares with August 7, 1897, as follows: Interest and dividend received, $147,437, decrease $19,586; collateral trust bond interest and expenses, $106,223, decrease $13,590; net profit from income, $41,213, decrease $5,997; profit from sale of underlying bonds, $92,662, increase $52,467; surplus from the previous six months, $182,927, increase $176,119; total, $316,803, increase $222,590. Last year there was $50,672 charged off as against nothing this year, while this year $35,000 was paid in preferred stock dividends and $100,000 carried to special reserve as against nothing in 1897, leaving a surplus of $181,803 as against $43,541 for 1897. The collateral 5s were redeemed at about 4.03 per cent. over the subscription price. The price of underlying bonds sold on an average of about 87.63. If the remaining underlying bonds were sold at 67.1 the proceeds would retire the balance of the collateral trust 5s at 103. The semi-annual statement gives the total assets as $5,033,803; capital stock, $1,500,000; collateral trust 5 per cent. bonds, $3,352,000.

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EDITORIAL NOTES.

Methods in Bidding that Should Not Be Countenanced.

It is a well-known and deplorable fact that town councils and lighting commissions are given to asking for bids on apparatus and appliances and then handling those bids when submitted in a way that is scarcely comprehensible to a business man imbued with an ordinary sense of justice. Because a bidder undertakes, after all bids have been submitted in good faith and published, to obtain an undue advantage of his competitors, there is no reason why a board of commissioners should abet him in his attempt and sacrifice their self-respect for the sake of saving to the city they represent possibly a few paltry dollars. A case of this nature which recently transpired in Detroit, Mich., will readily explain our meaning. The city was in need of 100 arc lamps, and accordingly asked for bids. Two bids only were received, one from the General Electric Company and another from the Adams Bagnall Electric Company. The former concern agreed to supply lamps at $20 each, while the latter offered lamps at $17.25 each. Both bids were referred to the city's electrical engineer, who was asked to report on the relative value of the two makes of lamps. This he accordingly did, stating that both lamps were satisfactory, and further recommending that the offer of the lowest bidder be accepted. The bids had meanwhile been made public, and no sooner had the representative of the General Electric Company informed himself of his rival's bid than he appeared at a meeting of the lighting commission and offered to furnish the lamps required at $17 each or for twenty-five cents apiece less than the Adams-Bagnall Company. His only excuse for making such an offer was that his company already had more than 1,700 lamps in use in that city, and was anxious to keep the business of Detroit for the sake of the advertisement. Let it be said in justice to the commission that they refused to accept his offer as being manifestly unfair to the other bidder, but instead of refusing to listen to any further proposition from him, they finally agreed to his suggestion to reject both bids and call for new ones, with the understanding that his offer of $17 per lamp was to hold good in case the new bids were not acceptable. The General Electric Company's representative then had the audacity to request the newspaper reporters present not to publish his offer, as by so doing they would give away his figures to his rival. We are not surprised at his not wanting the details of such a transaction made public.

That the representative of a supposedly reputable concern such as the General Electric Company should stoop to such means to an end is incomprehensible. On the other hand the lighting commission is decidedly to blame for countenancing any such proceedings with a view to saving $25 to a city such as Detroit on an order amounting to over $1,700. There is too much jugglery of this character going on between bidders and purchasers, especially town commissions, and the sooner it is frowned down the better it will be for the electrical industry.

* * *

How Electric Light Carbons are Dutiable.

The Board of Classification of the United States General Appraisers recently announced a decision regarding the tariff on electric-light carbons which will be found of interest to all those engaged in the electric lighting industry. According to the tariff act of July 24, 1897, paragraph 98, imported carbons were chargeable with duty at the rate of 90 cents per hundred. Prior to the above date carbons were commonly imported into this country in lengths of from 4½ to 14 inches and occasionally as long as 16 and even 20 inches. No sooner had the act of July 24, 1897, become a law, however, than foreign manufacturers began turning out carbons in lengths of 24, 29 and 36 inches each, with the evident intention of getting around the tariff act then in force. By cutting these sticks into proper lengths the importer would be getting practically two to three hundred carbons while only paying the tariff on one hundred. With a view to preventing this apparent evasion of the tariff act, the Treasury Department on October 27, 1897, issued the following instructions to the Collector:

"In order to reach an authorized decision on the subject, you are hereby directed to classify such carbons at the rate of 90 cents per hundred, according to the commercial length which existed at the time of the tariff act of July 24, 1897, so that sticks of carbon 36 inches in length would be chargeable with duty as consisting of three carbons of twelve inches each, and other lengths in proportion."

Thus the Collector divided these sticks into lengths of twelve inches each and assessed each of the fractional parts thereof as a separate carbon suitable for electric lighting at the rate of 90 cents per 100. The matter was carried before the Board of General Appraisers.

The contention of the importers was that they were specially provided for under Paragraph 98 as "carbons for electric lighting," and were dutiable as such at 90 cents per 100 without regard to any question of lengths.

On the other hand, the Government contended that, while they were not in their imported condition "carbons for electric lighting" of the commercial character and length commonly imported and known as such on and prior to July 24, 1897,

they can be mentally divided into lengths of twelve inches or less, and made dutiable in these reduced lengths by the hundred at the rate named.

Judge Somerville, who writes the opinion of the Board of General Appraisers, says that the articles are not suitable or capable of being used for electric lighting in the lengths and condition in which they are imported, but in order to adapt them for such use it is necessary to cut them up into shorter lengths, to point some of them and smoothe or grind the ends of others, and that prior to July 24, 1897, carbons of 24, 29 and 36 inches in length were not imported into this country, the usual lengths being from 4½ to 20 inches. He adds that the mere fact that at the date of the passage of the act the goods had not been manufactured or imported "does not withdraw them from the class to which they belong when the language clearly includes them." Further, he says goods must be assessed for duty as they are and not as the Collector may fix them up by some mental process, otherwise there would be no certainty in any tariff law; therefore it was illegal to assess the duty at the rate of 90 cents for every twelve inches. Under the circumstances the board decides that these goods do not come under Paragraph 98 at all, but under Paragraph 97, which provides a duty of 35 per cent. ad valorem on "articles composed of carbon." As the length of the carbons was increased with the evident intention of evading the tariff act, Congress will undoubtedly take the matter up at its next session and either pass a new act or add an amendment to the existing one.

* * *

The United States Signal Corps in Porto Rico.

The question of placing in communication the various army corps in an enemy's country by means of telegraph or telephone lines is an all-important one. Probably wires were never more quickly laid or under more trying conditions than were those strung by the United States Army Signal Corps under Colonel Reber on the landing of our troops in Porto Rico. According to the New York *Herald*, Colonel Reber landed at Guanica while the auxiliary cruiser Gloucester was still engaged in shelling the lurking Spaniards on shore, and began running a telegraph line to Yauco, a town some ten miles distant. The object of speedily opening communication between Guanica and Yauco lay in the fact that the regular Spanish telegraph line running east and west connected with Ponce where General Miles was about to land. The Spaniards, with a view to placing every possible obstacle in the way of our troops, had not only cut most of their own telegraph wires, but had destroyed all the batteries and telegraph instruments as well. The cutting of the wires was of little moment as they could readily be repaired, but the destruction of all the batteries and instruments was a very serious matter, as all the supplies which had been sent from the United States to meet just such an emergency had gone astray. Some battery cells were procured from St. Thomas, however, and necessity being the mother of invention, the other apparatus and appliances needed were made hastily and in a crude manner from scraps of brass found in a near-by foundry. How quickly and well the necessary lines were run, and how efficient the service was under most trying circumstances, may be gathered from the fact that within one hour after the fight at Coamo General Wilson was enabled to inform General Miles that the town had been taken. It was nothing unusual for the Signal Corps to be running wires while under fire, frequently being obliged to separate themselves from the troops and carry on their work without an escort, thus exposing themselves to an attack of the enemy with no adequate means for defence. In reply to a question asked by the *Herald* correspondent, on August 12, as to how the Signal Corps was getting on, Colonel Reber is credited with the following statement:

"Oh, well, we are getting along pretty well. We have 170 miles running now, are operating five circuits, communicating with general headquarters and Brookes' headquarters at Arroyo, Wilson's headquarters at Aibonito, Henry's headquarters at Utuado and Schwan's at Mayaguez. When everybody gets to San Juan by various routes we will have about three hundred and fifty miles of wire, one line running almost completely around the island and three across it."

When it is borne in mind that this 170 miles of wire was either run or placed in working order and numerous operating stations equipped, in an enemy's country, in the short space of seventeen days, the United States Signal Corps, which has been operating in Porto Rico, and especially Colonel Reber, deserves the greatest possible credit, for through their speedy and efficient work the carrying on of the campaign in Porto Rico was unquestionably greatly facilitated.

* * *

Reduction in the Capital Stock of the General Electric Company.

At the adjourned meeting of the General Electric Company, held in Schenectady on August 17, the reduction of the capitalization was effected, in spite of the opposition on the part of W. L. Putnam in behalf of the minority preferred stockholders. Mr. T. Jefferson Coolidge, seconded by Mr. Phelan, moved that the capital stock of the General Electric Company be reduced to $20,827,200, which shall consist of 182,760 shares of common stock, par value $100, and 25,512 shares of preferred stock, par value $100, the now existing common and preferred stock and the number of shares of each holder being respectively reduced to three-fifths of the present amounts. At this point Mr. Putnam moved to adjourn and await the result of Mr. Livermore's litigation. This motion was put to vote and lost. Mr. Putnam then filed a protest against the action of the meeting, claiming the vote to be illegal for the following reasons: First, because the charter did not authorize the reduction; second, because such reduction would practically take 40 per cent. from the value of the preferred stock and give it to the common stock; third, because the common shares had been largely over-issued and had remained unpaid; fourth, because there was no sufficient justification for reduction on any grounds whatever.

All objections were overruled, however, by Mr. Coffin, and the tellers announced that the motion to reduce the capital of the company had been carried by a vote of 243,141 shares to 9,800 shares. By this action the capital stock of the General Electric Company is reduced from $30,460,000 to $20,827,200. This two-fifths reduction of the holdings in the stock of this company bears us out in the claim that we have all along made that the General Electric Company was over-capitalized, and although the reorganization that has just taken place is by no means as thorough as it should be it is extremely gratifying to us, as we cannot help but feel it was brought about through the efforts of ELECTRICITY.

It is not often that one has the opportunity of beholding such a sight as was enjoyed by thousands of patriotic Americans last Saturday. To see pass in stately array ships that only a few weeks previously had been in the din of battle and had come out victorious is a decidedly novel sensation for the younger generation, and in the memory of some is only to be compared to the grand review of the troops at the closing of the Civil War. The welcome extended to the battle-scarred warships as they sailed majestically up the North River to General Grant's tomb was only in keeping with the achievements of the fleet and but partially expressed the grateful sentiment of the people.

Under the Searchlight.

Notes and Comments on Various Topics.

An electric light plant of sufficient capacity to illuminate the entire camp has been erected at Montauk, and the canvas city is now a veritable scene of enchantment at night. The boys from Santiago, who are well enough to be sentimental, like to sit up after taps and gaze upon the spectacle.

* * *

Prof. Callendar, recently of the staff of McGill University, Montreal, has designed a platinum electrical resistance thermometer capable of measuring temperature to the ten-thousandth part of a degree. The extreme delicacy of the instrument makes it a valuable aid in securing accurate observations of the temperature of lake and river waters during the various seasons of the year, as no thermometer is available for such minute measurements.

* * *

The Union Traction Company of Philadelphia is being sued by two of its former employes who were recently discharged for "conduct unbecoming employes." Who shall determine what the conduct unbecoming an employe is?

* * *

A leading Denver lawyer has been disbarred from practising in the Federal courts because of offensive language used in a brief against a judge. He is greatly surprised at this, as he only referred to his honor as "a calloused, cool, judicial liar, with the backbone of a jelly fish and the courage of a mud turtle."

* * *

From all accounts a concern in St. Louis is about to receive an order for 150 very fine motor cars for use in Japan. When completed these cars will be shipped to Kioto by way of San Francisco. The Japanese evidently think well of the electrical appliances made in this country.

* * *

A Novel Transfer System.

Reading, Pa., is in a state of revolt over the new system of transferring passengers that has been introduced on all the street car lines. On every transfer is pasted seven little faces, five masculine and two feminine. Of the former, one is bearded, the second mustached, the third side-whiskered, etc., while the distinction between the pictures of women is merely that of young and old. In the case of a man the conductor gives one glance, punches out the face that most nearly resembles the would-be transferer and hands over the ticket. That is easy, but imagine the conductor's feelings when he has to decide on which side of the dividing line between youth and age he must place women. Some painful scenes have resulted from this system, and the conductors declare that either it must be abandoned or else the cars must be equipped with conning towers.

* * *

A fender has been invented, says a New York paper, that might be used to prevent the Brooklyn trolley from breaking its own record. The fender is on wheels and is of steel, resembling in outline a chair. There are two wheels which turn independently of the trucks. Dummies have been set on the tracks and have been whirled into the chair, apparently without a jar.

* * *

An iron worker while fitting into place a steel column recently in Newark got a metal splinter into one of his eyes. He visited several physicians with a view to having it removed, but most of them feared to undertake such a delicate operation, which might result in the loss of his eye. It was finally suggested that an attempt be made to remove the splinter by means of a powerful magnet. This was accordingly done, and after a slight incision had

been made in the eyeball near where the splinter entered, it readily responded to the force of the magnet.

* * *

A NEW range-finder is about to be erected at Fort Hancock, Sandy Hook, as the instruments now located there are out of date and not to be relied upon for furnishing correct data; at least so it is claimed. Had a Spanish fleet attempted to force the harbor, however, we feel convinced it would have been stopped, old range-finder or no range-finder.

* * *

Electricity in Religion.

According to the New York *Times*, a collector of old and rare books recently came across a peculiar book bound in metal with what seemed to be an electrical appliance at one end. The volume was a copy of the Protestant Episcopal Book of Common Prayer, translated into the language of the North American Indians of Dakota.

The covers of the book had been carefully reinforced with substantial plates of nickeled brass, firmly fastened with five strong rivets on each side. At the top of each cover was an appliance for the insertion of an electric wire.

According to the story told by the seller of the book, the work was used in its present form by a missionary to the Indians in connection with an electric battery. While the unconverted brave whose soul the missionary desired to save held the prayer book with his hands on both covers, thus forming an electrical circuit, the latter would surreptitiously turn on a gentle current, which sent mild but appreciable thrills through the frame of the savage. These he believed to be manifestations of the newly-found religion.

We wonder how many savages were converted by this method.

MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Delegates to the Jubilee Meeting of the American Association for the Advancement of Science began to arrive in Boston as early as the 18th inst., and by the morning of the 22d most all of them were on hand. The representation this year is the largest ever present at one of the meetings of the Society. Previous to the general session at 10 o'clock on the 22d, in the Institute of Technology, a meeting of the Council was held and over two hundred new members were elected into the Association.

The local committee had perfected the arrangements for the whole meeting, and provided each member with an elaborate guide book and much information concerning the chief places of interest in and around Boston. They also arranged for the accommodation of the guests of the Association in an admirable manner. Boston received the members of the Association as a royal host and outdid herself in endeavors to cater to the enjoyment of her guests.

The city officially regards this semi-centennial meeting of one of the foremost societies in the New World as among the most important ever held in its precincts.

President Wolcott Gibbs called the opening session to order at 10:30 A.M. Prayer was offered by the Rt. Rev. William Lawrence, Bishop of the Diocese of Massachusetts.

The most noteworthy features of the programme of the morning's session were the addresses of welcome delivered by His Excellency Roger Wolcott, Governor of Massachusetts, Mayor Josiah Quincy and President James M. Crafts of the Massachusetts Institute of Technology. Désiré Charnay, in behalf of the French Government, spoke of the bond of sympathy existing between the two peoples. His address was in the French language, but was received with prolonged applause and much enthusiasm.

Governor Wolcott was in fine voice and by his masterful delivery held the rapt attention of his audience throughout. Among other things he said:

"It is with far more than ordinary pleasure that, on behalf of the Commonwealth, I extend a most cordial greeting to those who are present here to-day. The American Association for the Advancement of Science on this its fiftieth anniversary has done well to return to the soil of the Commonwealth which was the place of its birth, and which gave to it its charter. I welcome you all—those who come from the many cities of our country and those who come from foreign lands. The Commonwealth is honored by your presence. As seekers after truth you have devoted your lives to following the footsteps of science whether her majestic way is across continents, following the pathway of stars, or whether she delights to follow the minutest particles revealed by microscopic research."

Governor Wolcott then described at length in an eloquent and scholarly manner the many benefits coming to the world by the researches of men of science, and compared them to the men who have erected lighthouses on the coast, guiding and directing the course of those who will come after them. He spoke of the infinite possibilities of science, and said that in spite of the great advances that have been made, little is known to day of the mysteries of nature, so elusive is its touch.

Mayor Quincy was next introduced, and after referring to what the American Association for the Advancement of Science had accomplished, welcomed it to Boston in the following words:

"I heartily congratulate the American Association and welcome it back, after fifty years, to the scene of its birth, and extend thanks and welcome on behalf of the city of Boston to each and every one of its members in view of this meeting here, and the work which the Association is yet to do in the first half of the century to come."

President J. M. Crafts of the Massachusetts Institute of Technology then welcomed the Association on behalf of the Institute, and among other things said:

"Scholars who have walked the fields with Gray and Agassiz, who have learnt their mathematics from Peirce, their anatomy from Wyman, or their chemistry from your retiring president, might look the world over without finding leaders better fitted to guide them to the innermost chambers of scientific knowledge. In this place it is most fitting to mention the chairman of the first meeting of this Association, William B. Rogers, who was a born educator. He loved science for its own sake. His later years were devoted to the Institute which he built up, and which, now largely grown from small beginnings, has the honor of welcoming you this day; and it was on this stage that he fell, an unfinished sentence on his lips, giving his life to the cause which overtaxed his strength."

In retiring, President Gibbs introduced Professor Putnam of Harvard University, the President elect, who on taking the chair was received with vigorous applause. He said that in accepting his charge he felt overwhelmed as with one of the greatest honors that could be conferred upon him. He paid a fitting tribute to the founders of the Association, the officers who had directed its affairs, and others connected with its management. He urged scientists to join the Association in order to broaden their knowledge of science in general, and profit by intimate acquaintance with men of other branches.

Upon the adjournment of the general session the meeting was divided into nine sections in order to specialize the work of the Association in the different departments of science.

During the week a large number of important papers are to be presented dealing with almost every branch of science, there being a number especially on electrical subjects which should prove of material value.

Part Played by Electricity in the War with Spain.

In the New York *Sun* of August 21 there appeared a very interesting article on the naval lessons taught by our recent struggle with Spain. One of the officers of the battleship Texas is credited with making the following statements:

"Electrical appliances on the modern war-ship and in the various auxiliaries of up-to-date warfare, cannot be said to have had a fair trial as yet. Certainly they have not been of any great use in either of our big sea fights, although this is not saying that they might not be of the greatest importance under other circumstances. Before war was considered a serious possibility, eminent electricians made forecasts of many new, strange and valuable uses to which electricity would be put in the next contest between civilized nations.

"Ships were to be blown up while sailing over mine fields unconnected by wires with shore battery. They were even to photograph themselves on a chart in the shore room of an operator, who would then send a direct current to the mines through salt water. Torpedoes were to be projected through the air to drop on a ship and destroy it. Electricity was to be their propelling as well as their guiding force. Now, what of all this has been realized? What have we learned of mines and torpedoes? About all that is practical as the lesson from the mines in Santiago and Guantanamo harbors, of which the one on our deck is a specimen, is that submarine mines ought to be taken up and inspected at least once a month to keep them efficient. Otherwise, in tropical climates at least, mines will be so injured by general fouling and the contact pins so overgrown with barnacles that the whole thing will be useless and harmless. Not a torpedo has been exploded in the course of the war, and the attempts of the Spanish torpedo boats to get near our vessels were so quickly frustrated by the use of the searchlights that this arm of naval warfare for which so much was prophesied may be pronounced practically barren of results.

"It is in the operation of the searchlight, by the way, that electricity seems to have been of the greatest practical benefit. In blockading work, such as has principally occupied the American squadron off Cuba, the usefulness of the searchlight in guarding harbor entrances and sweeping the shallow inshore waters where light-draught vessels may otherwise slip by unobserved, has proved of the greatest value. When Admiral Cervera was bottled up in Santiago harbor the Texas and the Brooklyn or some other of the fleet kept their searchlights playing on the narrow harbor entrance every night, and it would have been an impossibility for the Spanish commander to sneak out under cover of darkness, as some of his critics have suggested he should have done.

"The electric searchlight may be put down on the list as one of the modern improvements which have really a practical value in war. One of the Brooklyn's turrets has been operated by electricity instead of by steam or hydraulic power, as the turrets of the Texas are, but we have not yet heard any report as to whether this motive power was found to possess any advantages or not.

"It is a striking fact that the carefully contrived range-finders and other delicately poised appliances for improving the accuracy of a ship's fire seem to have been forgotten in the heat of the conflict. So far as I have heard, the guns of the Oregon were sighted and fired in the old-fashioned way. I know that those of the Texas were, for the simple reason that our guns are not fitted with range-finders. We used the stadimeter to determine the range and sighted the rapid-firers just as used to be done with the old-style gun. And yet I think that for accuracy of fire the work of the Texas's gunners left little to be desired. This, of course, is not saying that the range-finder is not a most useful instrument, especially for long-distance work, but merely that it was not brought into play in the Santiago fight, nor in the battle of Manila, which was fought at even shorter range."

DUCRETET ON HERTZIAN TELEGRAPHY.*

In a lecture delivered before the Société Internationale des Electriciens on June 1st, M. E. Ducretet describes a new arrangement of apparatus for automatically printing messages in the Morse code. This has, of course, already been done by Marconi, Slaby and others who have worked at this subject, so that Ducretet's improvements are only in the details of the apparatus.

M. Ducretet gives a short account of the discovery of electric waves and their practical application to telegraphy without wires, in which the work of Marconi is scarcely mentioned, and much prominence is given to the discoveries of other inventors, chiefly French and Russian, that we do not hear much about in this country. According to Ducretet, Sarasin and de la Rive were the first to show that the efficiency of a Hertz oscillator was considerably increased by causing the spark to pass through an insulating liquid instead of air.

It is to Prof. Popoff, of St. Petersburg, however, that Ducretet gives the credit of being the first to discover telegraphy without wires in 1895; Marconi's discovery having been made in the following year. We do not intend to discuss these rival claims, but give here only the opinions of M. Ducretet.

Prof. Lodge in England, and MM. Le Royer and Berchem of Geneva, have since 1893 successfully employed Branly's tubes with filings instead of the Hertz resonator for detecting the presence of electric waves generated at a distance.

In 1890 Branly first showed the action of electric radiations upon discontinuous metallic substances such as filings, free or agglomerated in an insulating substance, and comprised between two conductors forming a circuit containing a battery and a galvanometer. These substances, originally insulators, or at least of very high resistance, became conductors when they were struck by an electric wave; and, besides, their conductivity was annihilated by a shock, only to reappear again when struck by another electric wave. The galvanometer placed in the circuit of the tube of filings deviated very strongly when the tube of filings was struck by an electric wave, and then returned to zero when the initial resistance was restored by a shock.

Branly has given the name of radio-conductors to his tubes of filings, a name which is intended to recall the fact that the conductivity of these tubes is established by electric radiations emanating from a spark. The sensitiveness of these detectors is very great, and they detect electric disturbances at a distance, even across partitions and walls. If the galvanometer is replaced by a sensitive telegraphic relay, we are able to produce in a local circuit energetic actions whose point of departure is the electric wave transmitted through space by an intermediary medium, the ether, which propagates electric vibrations from the spark transmitter in the same way as it propagates luminous vibrations.

We have thus all the elements necessary to the realization of Hertzian telegraphy; if the sensitive relay controls the electro-magnet of a recording apparatus, and long and short emissions of electric waves can be produced at a distance, then a message can be sent by the Morse code. The relay also controls the electro-magnet of the tapper which acts upon the filings of the radio-conductor. Each wave will thus be followed by a shock, bringing the radio-conductor back to its initial resistance. In practice the power of the transmitter will be adapted to the distance to be traversed.

The apparatus described and realized by Prof. Popoff in 1895 was constructed as follows: To record the electric waves produced by atmospheric electric disturbances at a great distance, he employed an instrument of the Morse type. Since 1895 Popoff has shown in various publications that his apparatus might be practically employed by the Marine for the transmission of signals. To augment the sensitiveness of his apparatus, Popoff connected one of the electrodes of his radio-conductor to a metallic wire, insulated, and fixed vertically along a mast. The other electrode was put to earth. This same arrangement may be applied to the spheres of the spark transmitter.

The insulated conductor of the receiving apparatus is a veritable collector of the electric waves launched into space; that of the transmitter plays the role of a radiator. Their length ought to correspond to the distance to be traversed.

The organs of the system of wireless telegraphy invented by Popoff may be shortly enumerated as follows: Electric waves emitted by the oscillator-transmitter; a Branly radio conductor which becomes conducting when struck by an electric wave and closes the local circuit of the relay which works the recording apparatus of the receiver; an electric tapper which acts automatically on the filings of the radio-conductor. Under the action of the shock of the tapper the conductivity of the tube of filings disappears, and recovers its original state till a new electric wave strikes the sensitive tube.

Ducretet's apparatus which he showed to the Society contains several improvements on the apparatus of Popoff. Like all telegraphic apparatus it consists of a transmitter and a receiver.

The transmitter comprises a powerful Ruhmkorff coil. In the circuit of the primary wire is a vibrating interrupter with a quick break, or a continuous rotary interrupter according to the power of the coil. A special key produces the long and short emissions of waves. A battery of accumulators furnishes the electric energy.

It is this electric energy due to a current of a considerable strength, but of only a few volts EMF., which is transformed in the secondary coil into a current of very high EMF., in the coil used in these experiments, 200,000 volts. After this transformation the electric energy does not exceed 60 watts, say one-twelfth of a HP. This heightened EMF. produces sparks which play between the spheres of the oscillator.

This oscillator is formed of several spheres between which play intermittent sparks produced by the operating key. The central spheres are plunged in an insulating liquid, and the oscillating sparks play between them. This oscillator is constructed according to the data given by Prof. Righi, but Ducretet's arrangement insures a rapid control of the length of the sparks.

From this oscillator the electric waves start which act at a distance upon the receiver.

The receiver comprises: 1. The Branly radio-conductor with its automatic tapper arranged according to Popoff. Ducretet's model has a device for regulating the position of the cylinders between which the filings are placed. The action of the external air on the filings is prevented by making the cylinders a good fit.

2. A mast with an insulated wire (Popoff's collector), and an earth connection to one of the electrodes of the radio-conductor as already described.

3. A very sensitive telegraphic relay putting in action both the electro-magnet of the recording instrument and the electro-magnet of the tapper.

4. Recording instrument. In Ducretet's arrangement the working is automatic, and allows the telegraphist to be dispensed with. This point he considers of great importance. The first wave that arrives starts the ribbon, and when the waves stop the ribbon stops.

Popoff has sent messages over a distance of 5 kilometers at sea, with a vertical conductor 18 meters in height. Marconi has traversed a distance of 16 kilometers with a vertical conductor 30 meters in height. Experiments made recently with Ducretet's apparatus show that these records can be beaten.

It is not necessary to conclude from these experiments that Hertzian telegraphy without wires will replace ordinary electric telegraphy, or optical telegraphy; but from the results attained it is possible to see the service it may render in communicating between ships, and between ships and the coast, and for military and exploration purposes. M. E. Aimé is about to test wireless telegraphy as a means of communicating between balloons and the earth.

Branly has recently shown that a battery of 12 accumulators may be put in circuit with a powerful radio-conductor, and that the current may be raised from zero to 20 amperes when the tube is struck by electric waves.

With a special kind of relay (*un electro aimant à déclic*) Ducretet was able by means of electric waves sent from a distance to (1) make a long metal wire incandescent; (2) start an electromotor; (3) excite a powerful electro-magnet; (4) illuminate a row of incandescent lamps; (5) explode a mining fuse.

* From the *Electrical Review*, London.

Magnetization and Length.

The small changes in length produced in a bar by magnetism have been investigated by many experimenters. Mr. J. S. Stevens, however, is, we believe, the first to use interference methods for measuring the changes so produced. He describes his experiments in a recent number of the *Physical Review*. The "interferometer" has now become so well known that it will not be necessary to describe it again. This instrument was used with slight modification of its construction. The mirror frame, which is commonly attached to the movable bed was removed and firmly screwed to the end of the rod to be tested. The other end of the rod was made fast to a brass cylinder, which could be moved backwards and forwards, and thus provide the adjustment usually afforded when the mirror is moved by means of a micrometer screw. The magnetizing coil was supported so that adjustment in two directions was possible. The whole was attached to a heavy wooden frame and little or no inconvenience was caused by vibrations in the building.

The magnetizing coil was composed of 15 layers of No. 25 copper wire, and was 21 cm. long. It had a resistance of 420 ohms. Current was afforded by a storage battery of 110 volts. The rods were 30.5 cm. in length and 0.953 cm. in diameter. Tests were made with wrought iron, cast iron, steel, copper, brass, nickel and aluminum. In conclusion, the author claims the following as the points of advantage of the method: Since the mirror is practically a part of the rod, little or no annoyance due to vibrations of the building was experienced; the measurements are direct and the unit so small that the error need not exceed 1 per cent.; the errors liable to occur in any mechanical device, such as the use of levers, indicators and the like, are eliminated; any auxiliary effects, such as distortion, are closely seen.

Electrical Governor for Marine Engines.

To prevent the engines of a vessel from racing when the screw rises above the water, Sig. E. Putalo has invented an electrical regulator. It consists, according to *Industries and Iron*, of two vessels of mercury, connected at the bottom by a tube, and mounted fore and aft in the ship. The vessels are about half full at normal depth. When the ship pushes forward so as to raise the screw the rods connected with the resistance are submerged one after the other so that an electromagnet is brought into play, the whole resistance being short-circuited when the screw is quite out of the water. The electromagnet operates a throttle valve in the main steam pipe, which is thrown open by another magnet. By this arrangement the steam is turned off and on. From experiments it has been shown that the mercury vessels need not be more than 34 inches apart on a ship 300 feet long.

COMMERCIAL FORMS OF ELECTRICAL RESISTANCES USED FOR LIGHTING AND POWER PURPOSES.*

BY L. B. ATKINSON.

In the early days of electrical engineering, when telegraphy was the leading branch of the science or industry, "resistance" as a property of the electric circuit had very important functions, and from the property of circuits that the resistance is proportional to the length of the conductor, in the case of faults occurring on telegraphic lines it became a means of increasing the distance from the end of such fault. And for such purposes, therefore, standards of resistance were used which were carefully calibrated, and the primary value of such resistances rested in their accuracy. Such for telegraphic purposes is still the case, but the growth of the use of electricity as a means of transmitting and distributing light and power has given rise to the use of resistances for quite other purposes, and having other requirements than that of representing an absolute or accurate value, and it is to these resistances that the present paper is devoted.

The current in an electric circuit is defined by Ohm's law; that is:

$$\text{Current} = \frac{\text{Electromotive force}}{\text{Resistance}},$$

so that for most purposes the EMF. is fixed, the resistance of the circuit is the variable by which the current is to be controlled. And thus for almost every conceivable use of electricity for lighting or power purposes, resistances are used as controllers or regulators of the current.

The functions of a resistance being primarily to regulate or determine the amount of the current, which it does by its resistance, its second function is to dissipate the heat produced by the electric power expended on the resistance. This becomes a matter of cooling surface, and leads to a wide range of possible designs.

Speaking generally then, in considering electrical resistances, the points to be considered are the (1) material of which the electrical resisting circuit is composed, (2) the nature of the support for such circuits, and (3) the material for insulating the circuit from the support, and in addition the nature of the switching mechanism for varying the amount of resistance in circuit.

(1) MATERIAL OF WHICH THE ELECTRICAL RESISTANCE CIRCUIT IS COMPOSED.

Since all conductors offer resistance to the passage of the electric current, any conductor may be used as a resistance. The following table shows the resistance of one centimeter in length of various metals and alloys, carbon and liquids, the cross sectional area of the specimen being one square centimeter and the temperature 0° C.

TABLE I.—*Specific Resistances.*

	Resistance per cubic centimeter.	Percentage variation per degree centigrade.
Silver	1.594 microhms.	.377
Copper	1.598 "	.388
Iron	9.716 "	.458
German-silver	20.93 "	.08
Platinoid	51.0 "	......
Manganin	52 0 "	Practically nil.
Eureka	60.0 "	" "
Rheostene	100.0 "	" "
Carbon	4200-40000 "	— .2
Relugite	8.2 to 8200 ohms.	— .2
Solution of soda, 10 % solution	11.5 ohms.	......
Solution of zinc sulphate, density 1.405	28.3 "	.....
H_2 SO_4 density 1.10	1.37 "	— 1.7

This table is only to be used as a guide, since, except with pure silver and copper, all the other materials are of somewhat undefined composition, and the resistance of alloys and carbon varies greatly with their chemical and physical condition. It will be observed that several of the materials used are special alloys, for the most part of nickel and manganese, which, in addition to having a very high resistance, have a very small temperature coefficient, which is important, as resistances are often worked to a temperature of 200° C., causing a very considerable variation of resistance.

An interesting example of this is in the use of iron wire when it is approaching a red heat, in which case it will be found that the resistance rises so rapidly that a very large increase of EMF. will only cause a very small increase in the current, because as the EMF. is raised, causing a small increase of current, this raises the temperature so that the resistance rises almost as fast as the EMF.

The writer some years ago used this property for arc lamp resistances, when even if the lamp was cut out the permanent rise in current was quite small.

The metals, solids and liquids shown in the table are those which are most frequently used for making resistances, and with regard to these the usual form of the metals and alloys is in the shape of wire or strip, the former generally wound into coils.

Carbon may be used either in rods, in which case the ends should be electro-coppered and the connections clamped and soldered to the copper, or the carbon may be used in the form of flat plates piled on one another.

The material "relugite," shown in the list, is a new material now being put on the market by the Electric Insulation Syndicate of Cardiff, and having an incombustible base, such as asbestos, in which is deposited conducting carbon, and the specific resistance of which can be made as required within the limits given, and this material also may be used either in strips, the current passing from end to end, or in plates or layers through which the current passes.

Liquids are used generally where high resistances are required, and are on the whole an unsatisfactory form of resistance, as the solutions creep and cause loss of insulation on the circuits to which they are attached, whilst the liquids also leak or evaporate, so that they have to be made good, and the composition and resistance are constantly varying.

Carrying Capacity of Resistance Materials.—It is important to determine what is the carrying capacity of the wires, strips or plates of which a resistance is composed; this being defined in relation to some particular allowable rise of temperature. The rise of temperature to be allowed is probably the point on which the greatest difference of opinion seems to exist among manufacturers.

It is somewhat curious that the fire insurance offices, who define to a nicety the insulation of the circuit and other quantities, are exceedingly vague on what is probably one of the chief fire risks that are run, most of the offices satisfying themselves by merely stating that the resistance should be constructed of and mounted upon incombustible material, and that no combustible material should be within a foot of the resistance.

Since most organic matters and fabrics char at a temperature of 200° C., the writer thinks that that limit at all events should never be passed, and probably the rule defining that the maximum temperature of the hottest part at the maximum working load should not exceed 150° C. would be a safe rule.

The principal methods of dissipating heat from resistance are by radiation, air currents, and in certain cases by circulating liquids such as oil or water.

The amount of heat radiated at the temperatures discussed is not large, and the use of liquids for cooling is not common, so that practically speaking cooling by air or currents is the usual method.

It is obvious therefore that the design should be such as to allow a free circulation of air through those parts where the heat is being produced.

Wire Resistances.—For this reason where wires are used it is advantageous that the diameter of the wire should be small, so as to give a maximum surface for a given cross sectional area, and to carry the requisite current a sufficient number of wires should be placed in parallel.

Again, where wires are wound into coils, these coils should be open, and there should be a space between successive turns of the coils of 2 or 3 diameters to allow an effectual passage of air.

In the case of long coils placed vertically, the upper parts of the coil become far the hottest, as the air heated by the lower coils is the only cooling medium.

It is almost impossible to give any general rule as to the carrying capacity of wires in coils.

If the wires are in coils drawn out so that the space between the wires is about 2 diameters, the current the wires will carry for the same temperature will be about one-third of that given by the diagram.

One of the most effective forms in which wire can be used is in the form of wire gauze, and the best class of gauze is that in which the longitudinal wires carry the current, the wires all being in parallel connection, whilst the cross threads carry away the heat, and in this case the load to be carried by a given wire is double that given in the table.

A great difficulty occurring with wire resistances, particularly where alloys, such as german-silver, are used, is that the wires become brittle or rotten and break, causing short circuits and danger of fire.

In the case of resistances enclosed in boxes so that only the outside surface will dissipate the heat, the carrying capacity of the wires is much less than that given in the table, and the ultimate carrying capacity of the resistance will depend on the surface of the casing exposed to the air, and for a temperature of 150° C. the total external surface should be about 10′′ per watt to be dissipated.

The surface for this purpose may be increased, if of metal, by casting ribs or fins upon the casing so as to increase the surface.

Some resistances are only required for a short time at intervals, such, for instance, as resistances for starting motors, and here the element most to be considered is not the surface on which depends the power of steadily dissipating heat, but the total specific heat of the parts on which depends the rise of temperature with the given load in the time for which it is to be used, and in this case materials having a high specific resistance with large bulk may be used to advantage, or if fine wires are used they may be imbedded in material such as enamel or sand or asbestos which will absorb by conduction the heat from the wire itself.

Carbon Resistances.—A common form of carbon resistance consists in the use of ordinary lighting pencils with the ends coppered and connected up by clamps.

These resistances for testing purposes can be run at a very high temperature, but they dissipate heat badly, they are very liable to come broken, and are not often used for resistances which may have to be transported.

Carbon resistances made up of plates placed in a frame are often used, and they have the advantage that the resistance may be varied by screwing them up more or less tight by a clamping screw.

In this case a very large part of the resistance is due to the resistance at the surface of contact between the layers, and due also to the fact that the current travels in the plane of each layer from the points of contact at the surface of one set of plates to those of the next set; these, in most instances, not coming opposite to one another on the plates.

In other words, except when the plates are screwed up quite tight, the current is traveling by a zigzag course through the pile of plates, and it is principally this which enables the resistance to be varied.

The material previously mentioned, viz., "rel-

* Paper read before the Northern Society of Electrical Engineers at Manchester, Eng.

ugite," is used in the same way, and with the same results, but it has a great advantage over the carbon resistances in that the material being flexible and elastic, a much wider range of the screw is obtained, so that the resistance can be varied more gradually, whilst the tendency with solid carbon resistances for the plates to actually break contact, and so set up an arc, is got over.

The chief difficulty with carbon resistances is that they present a very small cooling surface.

This difficulty has been obviated in the case of "relugite" resistances by interposing metal plates between the plates of material, which metal plates are larger than the plates of the material, and thus serve to conduct the heat from between the plates, and to present a large surface for the air to pass through to cool them.

Liquid Resistances.—The commonest form of liquid resistance is a wooden tub filled with water in which is sulphuric acid, common salt, washing soda, or other metallic salt, to render it more or less conductive, and in which are immersed plates leading in the current.

Such resistances cannot, of course, rise above the temperature of boiling water, and they absorb a large amount of heat due to the large latent heat of steam.

Such an arrangement is of course a very rough one, and only used for temporary purposes.

For permanent installations iron or earthenware jars or pots are used, containing solutions, and having electros of various forms which can be moved in relation to one another.

(2) MATERIALS FOR SUPPORTING RESISTING WIRES OR MATERIALS.

In the early days of the use of electric power, resistance wires or coils were usually strung in wooden frames (see Fig. 1), and the writer believes he was

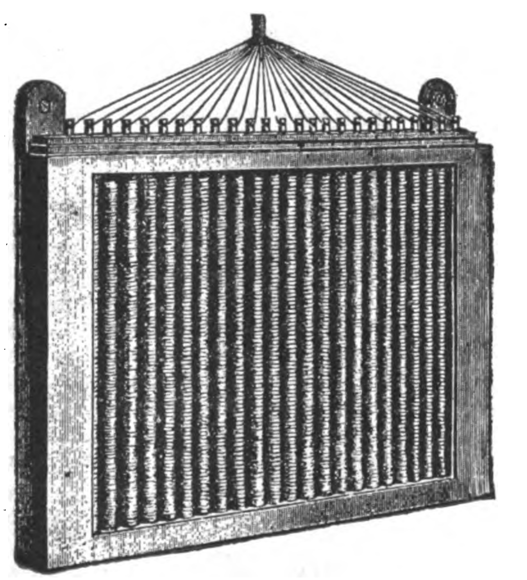


FIG. 1.

the first to introduce into the market standard patterns of resistances in which the supports were wholly composed of incombustible material—that is to say, iron frames carrying slate or porcelain insulating parts to which were attached the resisting wires—and Figs. 2 and 3 show designs which were registered by the writer in 1887, and large numbers of which were made by the writer's then firm.

These designs, slightly modified, have been largely adopted by different makers and are now on the market, all embodying the same important point of fireproof insulating supports for the wires.

These resistances may be, and usually are, provided with a switch having a number of contacts, which enables, more or less, the resisting wire to be included in the circuit.

A class of support previously mentioned is the use of enamel on a base of iron. In this case the iron is first enamelled, to give it an insulating coating; the wires, which are very fine, are then placed on the enamel, and covered with thick coating of enamel, which is then fused, so that the wires are formally imbedded in it.

The resistances known as the Carpenter resistances, and the resistances in most heating and cooking apparatus are arranged in this manner. In this

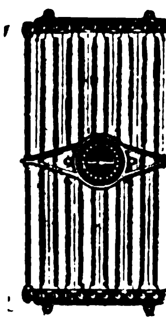


FIG. 2.

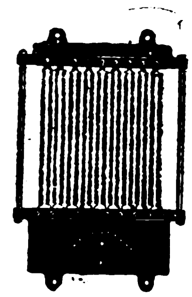


FIG. 3.

case the enamel carries the heat from the wire to the iron support, which then distributes it, and forms the cooling surface.

In the case of the "relugite" resistance material, this is carried in iron frames, generally on pillars or bolts passing through it, the insulation being enamel, and in certain cases mica or asbestos sheets are used where flat surfaces are to be insulated.

(*To be continued.*)

NOTES ON THE ELECTRO-CHEMICAL TREATMENT OF ORES CONTAINING THE PRECIOUS METALS.*

BY MAJ.-GEN. C. E. WEBBER.

The precipitation of gold and silver with the aid of an electric current has a history which may help my audience—many of whom, I think, are more or less acquainted with the subject—to appreciate the present situation of a question which cannot be devoid of interest to our Institution.

If we go far enough back in the subject, we shall find that in 1835 to 1840 Becquerel used a saturated solution of common salt for dissolving compounds of silver and lead, and subjecting the solution to the electric current, both to hasten the reactions of the process and better to utilize the precipitating agent.

In 1843 Prince Pierre Bagration described in the *Bulletin de l'Academie des Sciences de St. Petersbourg* some experiments with finely divided gold dissolved in an aqueous solution of potassium cyanide under the influence of the galvanic current, by which means he precipitated the precious metal on a copper cathode.

In 1867 Julio H. Rae proposed, in the United States, a method of treating ores containing gold and silver mixed with a suitable solution, such as one of cyanide of potash in water, by the action or aid of a current of electricity; suggesting at the same time in addition, the agitation of the solution.

Although Rae's proposals are said to have never gone beyond an experimental stage, in his description is found the combination of (1) a circular vessel to contain the ore; (2) a solvent in solution; (3) a stirrer, or agitator, on a vertical shaft, working with a rotatory motion within the vessel, the stirrer being connected with one electrode, and a conducting metal plate which supports the charge under treatment within the vessel being connected with the other electrode, or a source of electricity.

In December, 1882, Messrs. Breakell and Haycraft patented, in South Australia, a means of treatment of slimes by agitation combined with an electrical current and amalgamation. In nearly all respects they copy Rae, except that they use no solvent of the precious metals present in the mixture under treatment.

In their apparatus (Fig. 1), A is the vessel, or "pan," in which the operation is performed. B is a revolving shaft, carrying arms or rakes, C, C, which is connected by a contact, preferably of mercury, on the top of the shaft, with the positive pole of a battery. The bearing on which the axis revolves is insulated from the vessel. D shows the position of a pulley on the shaft by means of which it is revolved. The negative pole of the battery is connected with the vessel, which is of iron, or such suitable material; so that the vessel itself, as well as the mercury lying at the bottom of it, constitutes the cathode.

In passing, I must mention Barker's apparatus of 1882, for extracting gold and silver from "sands" containing them, in which we find the use of a mercury cathode, combined with stirrers on horizontal shafts which however did not constitute the anode.

Also Body's process of 1883, which combined a drum and ball crusher of ore containing precious metals. These had been previously ground and dissolved in a solution containing ferric salt. The axle or the revolving drum carries carbon anodes, and the walls of the vessel and the balls serve as cathodes, on which the noble metals after solution are deposited electrolytically. Mercury is used, but only for the purpose of collecting the free gold and silver.

I propose to avoid as far as possible allusion to the large number of inventions which deal chiefly with electrical amalgamation, but it is difficult not to refer to some of those which use electrical deposition. Thus, when, in 1888, MacArthur and Forrest investigated the chemistry of, and patented their world-renowned process, they seem to have neglected, or, having tried it, discarded, the assistance of electricity in combination with a weak solution of potassium cyanide, because of a greater expenditure of chemicals which they alleged to be the result, and also because they believed it encouraged the solution of any baser metals together with the gold and silver which might be present in the ore, and involved the extra expense of their separation.

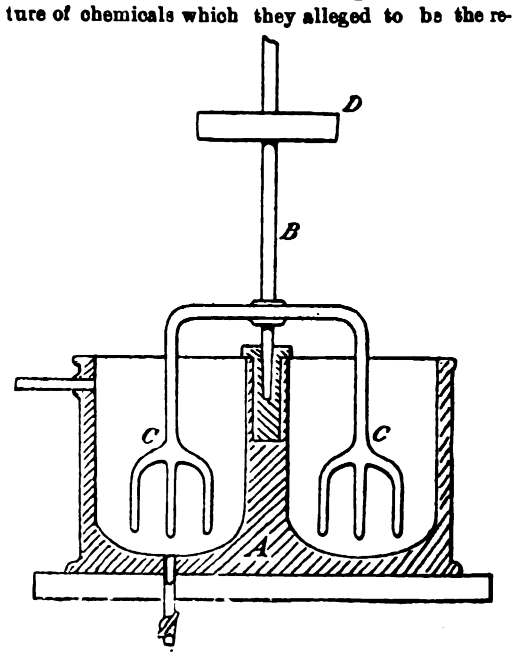


FIG. 1.

I need not here refer to the reasons for MacArthur and Forrest's rejection of electricity, nor to the well-known Siemens & Halske process,* in which "circulation" of the solution by gravity is an essential feature, as I wish to direct your attention more particularly to those processes in which the combination of similar conditions with "agitation" are included.

Following on Rae and Breakell, in 1891 Hannay described and patented in the United Kingdom a process and an apparatus for "extracting gold from minerals containing it, by subjecting the finely pulverized mineral mixed with a solution of cyanide to electric action and agitation in the presence of mer-

* Paper read before the Institution of Electrical Engineers, London.

* In 1896 added to, if improved on, by Stuart Croasdale. See *Engineering and Mining Journal* of 12th December, 1896.

cury." In this process—which it is not understood was ever put to work on a practical scale, and which it is believed, in common with his predecessors', is not described so that the ordinary intelligent engineering mind could erect the apparatus and work it successfully—there is found the combination of (1) a circular vessel or tank; (2) an electrolyte consisting of a solution of cyanide of potassium, mixed with pulverized ore; (3) a stirrer, or agitator, on a vertical shaft, standing in the middle of the vessel, and acting by rotation on its axis; (4) one electrode—the anode which in this case is a cylindrical block of carbon—being suspended or fixed in the middle part of the vessel. Two examples of the apparatus were published in December, 1891, and in one of them (the later one) we find another condition in combination with the above, which, so far as I can discover, but for the proposal of Breakell and Haycraft, in 1882, would be the first example in which the bottom of the vessel described as of "basin shape, containing mercury," as in the case of the ordinary amalgamating pan, is also the cathode. Examination of the description of this cathode will, I think, not satisfy electricians of its practical value without important modifications. The use of solvents or

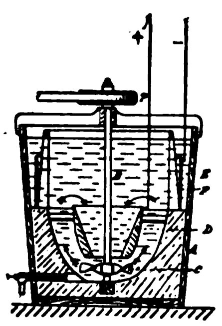


FIG. 2.

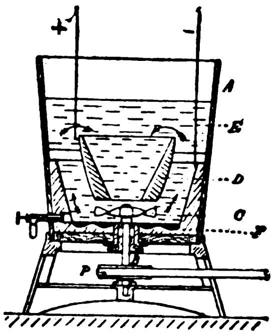


FIG. 3.

oxidizing agents other than potassium cyanide is not proposed, and the strength of the cyanide solution, current, etc., is not given.

There are two forms of this apparatus (see Figs. 2 and 3). In each there is a cylindrical vessel, A, with a revolving vertical shaft, B, turned by a pulley, P. The shaft carries what is called a "propeller," which serves only for the purpose of stirring the liquid contents of the vessel. In each section a hollow cup-shaped block, D, of carbon, is shown, which constitutes the anode, and is connected with the positive conductor from a dynamo. In the example No. 3 the cathode—which is formed of carbon plates, F, within an annular frame, F—is fixed above the propeller. In No. 4 the cathode is a body of mercury which lies in the "basin-shaped" bottom of the vessel.

There exists an interesting description of a process patented in 1893 by Mr. Molloy, M.P., who, between 1884 and 1887, had dealt with the subject in a different manner. Although it does not include all the features of treatment to which I wish to confine myself, its chemical reactions are not without interest to our subject. It involves at first sight two stages, but really it has four, namely :

First, the solution of the gold contained in a pulverized ore by means of bromine, chlorine, cyanogen or other compounds; secondly, the charging a mercury cathode, which forms the bottom of a treatment tank, electrolytically, with potassium or other alkaline metal, free potassium being taken up by the mercury; thirdly, the introduction to the tank of the solution, and its treatment therein; and fourthly, the recovery of the solvent by regeneration. In the first stage, although it is not so described, Molloy must subject the pulverized ore to a process of leaching to obtain his solution, say Au Cn.

The following equation expresses it :

$$HO + O + 4KCN = 2Au2\,[KAu\,(C\,N)_2] + 2KHO.$$

In the second stage, his alkali metal is an alkali salt, i. e., potassium carbonate ($K_2\,CO_3$) or a sodium carbonate, etc. No reference is made to the anode used in electrolytically charging the cathode, but the object to be attained is apparently that the mercury in the cathode should take up free potassium, forming an amalgam of these. This addition may be made mechanically as an alternative.

In the third stage, which is that in which the extraction of the precious metals takes place, the solution comes in contact with the previously prepared mercury. It is said that it "rests or passes over" it; so it is not an "agitation," though it may be called a "circulation" process.

Although it is not easy to gather from the inventor's description that he uses electricity in this stage it is evidently implied, because the reactions in the following equations could not otherwise be effected:

$$2\,[K\,Au\,(CN)_2] + H_2 = 2\,KCN + 2\,HCN + 2\,Au;$$
$$2\,CNH + 2\,KOH = 2\,KCN + 2\,H_2O.$$

In the first equation we have the action of the nascent hydrogen on the double cyanide of gold and potassium cyanide, producing metallic gold and hydrocyanic acid. The gold is precipitated and absorbed by the mercury, from which it is afterwards released in the usual way.

In the second equation we find that the hydrocyanic acid unites with caustic potash formed from the alkaline metal in the mercury, and re-forms potassium cyanide, which is one of the important features of the invention. The recovery of the cyanide will constitute the fourth stage.

The entire absence in the specification of the position of the other electrode, and the description of his apparatus being confined to merely the words "many forms of construction," seem to exclude claims to originality in that respect; there being no attempt to describe something that the ordinary engineering mind can construct or put to work.

In January, 1893, E. D. Kendall applied for, and in August, 1894, was granted a patent in the United States for a method which claims to be "a method" of treating pulverized gold and silver ores with sodium dioxide and a "suitable cyanide" in a water solution. The quantities of chemicals to the ton of ore are 2 lbs. of sodium dioxide ($Na_2\,O_2$) and 7 lbs. of potassium cyanide (KCN), but these may vary. The treatment may be by lixiviation, "with or without" agitation. And the precious metals may be separated from the lixivium by "electrolysis or other suitable means." No apparatus or special means are described.

Also, in December, 1893, Carl Pielsticker obtained a patent in New Zealand for the extraction of gold and silver from ores, both in the form of sulphide, and in ores in which the precious metals exist in a state of "extremely fine division."

The use of this process was chiefly the cause of the well-known litigation between the Cassel Gold Extracting Company, the owners of the MacArthur-Forrest process, and the Cyanide Gold Recovery Syndicate, by which an attempt to monopolize the use of potassium cyanide in all processes of gold extraction throughout the world, broke down. It is for this reason, and as helping to explain the difference between "agitation" and "circulation" in a cyanide solution, that my notes include its description.

Its essential features may be briefly described as "a process of separating gold and silver from their ores," which consists in treating the powdered ores with a solution of cyanide of potassium, in conjunction with an electric current of low tension used for the purpose of the deposition of the precious metals. In order that the process may go on continuously, he produces a circulation of the liquid through the space between electrodes, which are fixed respectively, the anode at the bottom and the cathode at the top of a tank.

It is claimed for the use of a current of higher potential specified to be used in the ore tank that "the precious metals are attacked more energetically by a cyanide solution in connection with a current of electricity than without." We are told that "free gold is certainly more quickly dissolved by cyanide of potassium in conjunction with an electrical current than without one."

To recapitulate : This process has, in common with Rae and his successors, the combination of a solution of potassium cyanide with an electric current, by which it assists solution and effects precipitation on a cathode; and in common with Molloy, it effects the treatment in more than one stage, and by means of "circulation." In this latter respect Molloy and Pielsticker are at one with the process of Siemens & Halske, in contradistinction to the processes in which "agitation" is essential. With reference to my observations further on as to "agitation," it may be here observed that in such processes the density of the sludge at various points in the system of circulation must depend on its rate of motion.

Edwards, in April, 1894, described, in the United States, an apparatus very similar to Hannay's, except that the position of the carbon anodes is altered, and they are apparently placed so as to line the sides of the treatment vessel.

It 1894 an invention was produced in the United States, and subsequently patented there and in other countries by Messrs. Pelatan and Clerici, for an electrolytic process and apparatus for extracting gold and silver from their ores and other compounds.

The process has been described as a single continuous one—an essential feature—because as such it has proved itself equal to effect in one operation all that can be expected of it. In other words, it receives the pulverized ore in a wet condition, and after being stirred up, and water if necessary added, so as to be in a condition of fluidity to allow of suitable agitation of the particular kind of ore under treatment, and so that the chemicals used in the treatment are properly mixed with the solution, it is introduced into the treatment vat or vats, in which the operation, which I shall again refer to, is carried out until nearly all the precious metals are extracted and absorbed by the amalgam at the bottom of the vessel or vessels. Although a preliminary mixing of the solution in a separate tank may be thus implied, there is nothing to prevent the mixing being carried out in the treatment tank itself.

In this we have, I believe, for the first time, a process and apparatus which effectively combines, in a way that can be constructed and worked by a workman of average intelligence, the following :

(1) A vat made of a material, dielectric in its nature; (2) an agitating apparatus of various specific forms, each form calculated to carry out one and the same process—being the result of considerable experience—having an agitator, part of which constitutes the anode in an electrolytic circuit, which is carried so that it can by no means make contact with the bottom or sides of the vat; (3) the presence of a cathode, which covers the whole of the bottom of the vat, made of a metal (preferably copper) plate or sheet, and suitably contained and fixed so as to carry on it a layer of mercury; (4) the use of a graduated current from an electrical generator, having large quantity and low potential; (5) the mixture or sludge under treatment being composed of water in given proportions, ore finely pulverized, potassium cyanide or other solvent of gold and silver, and common salt, with the addition as required during the process of alkalis or organic acids as may be required.

These are the chief features, together with important details of construction to which I shall refer further on, that constitute the Pelatan-Clerici process.

(*To be continued.*)

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE OVERHEAD LINE AND GROUND RETURN CIRCUIT OF ELECTRIC STREET RAILWAYS.*

BY DAVID PEPPER, JR.,
Member of the Institute.

On the proper design and careful construction of the line and ground return circuit depends, to a great extent, the satisfactory and economical operation of an electric railway. The practice of the present time is the result of costly experience. Within the last few years there have been great advances made in the character of the outside work, and the materials entering into the construction have been greatly improved. In the early days of electric street railways, the importance of the line, and especially the return circuit, was very little thought of. The cheapest form of construction that would cause the cars to move at all was usually installed. Managers now find that it is very bad economy to attempt to save money on their outside work. The direct loss in receipts and prestige, owing to failure of the outside construction, is very great, and the loss in power, owing to poorly proportioned or poorly constructed work, is a constant loss. The overhead trolley line should have sufficient strength in all its parts not only to hold up the dead weight of the trolley wire, but to resist all sudden and heavy strains caused by blows from trolley poles, the falling of outside wires upon the trolley wire, and the breaking of the trolley wire.

The trolley wire in city work is usually supported on iron poles placed, about 125 feet apart, in pairs on opposite sides of the street. These poles are usually made of from two to three sections of heavy iron pipe, telescoped into each other about 18 inches and the joints swedged while hot. On straight line construction, unless the street is very wide, poles 28 feet long and weighing from 700 to 750 pounds are used. On wide streets and light curves, and with extra heavy trolley wire, poles from 900 to 1,100 pounds are used. On heavy curves the poles weigh 1,300 pounds and over. In setting these poles great care must be taken that they are set in such a way that there is no give at the base of the poles. If the poles give after the strain is put on them, it will loosen up the entire line, especially at curves and special work, and cause a great deal of trouble in repairing. The lighter weight poles, when set in fairly good ground and with a curbstone in front, should be placed in holes from 18 to 20 inches in diameter and from 6 to 6½ feet deep, and set with a rake to allow for straightening when strain is placed on them. The concrete used should be made of 1½ bags of improved natural cement, one barrel of sand and sufficient stone to fill the hole. The sand and cement should be made into a thin mortar, mixed with the wetted stone, turned at least three times, and the mixture then rammed in the hole in six-inch layers. The concrete will be worthless if it is not properly rammed or if there is too much or too little water in it. For pull-off poles, and where there are heavy strains, two bags of cement should be used and the poles set in larger and deeper holes.

In cross suspension work the span wires are usually secured to poles with wrought iron bands and one or two mechanical insulators are placed in each end of span near pole. In the early construction silicon bronze and solid steel and iron wires were used for the spans. It was found that the tensile strength of these wires, if they were scratched or kinked in any way, was greatly reduced and that there composition was somewhat uncertain. Seven-strand galvanized steel cable is now used, $\frac{5}{16}$ of an inch in diameter for ordinary single-track suspension and pull-offs, and $\frac{7}{16}$ of an inch on long spans and ⅜ trolley construction.

Care should be taken in placing spans to allow for the proper sag when the suspension device is sprung on the span wire. If the span is tight, say having a sag of only 8 inches in 35 or 40 feet, there is great strain put on the pole. If the sag is too great, the line will look bad and violent vibrations will be set up in it every time a car passes. The exact tension of the spans is a matter of skill on the part of the man putting them up.

The insulators used in the span wire are of many types and makes. The insulation is usually hard-rubber compound or one of the many special compounds made for this purpose. There is a heavy strain sometimes placed on these span wires, and the constant vibration will quickly find any imperfections in the insulating material and cause either a break in the wire or a leak to the pole. Those forms of insulators involving screw connections are not usually as strong as those of rigid type, and, as the take-up is seldom if ever used in practice, it is better economy to use two solid strain insulators instead of a turnbuckle.

In many cases where the track is on the side of the street, a single line of poles is used and the trolley wire suspended from a pipe bracket, which is usually trussed in some manner. A plain bracket gives a rigid line which causes a great deal of wear and tear. To overcome this rigidity brackets are often made so as to rise a little under the pressure of the trolley, or the hanger is secured to a span wire under the bracket. Bracket construction, unless securely guyed, is much more liable to serious damage than span construction, owing to the lack of strength laterally if the wire breaks or if the trolley pole comes off and strikes the bracket.

We now come to the method of actually suspending the trolley wire. There is sprung on the span wire a casting of malleable iron or bronze, containing an insulated bolt of from ⅜ to ¾ of an inch in diameter. This insulated bolt is sometimes placed in the casting and the top screwed down. In others it is contained in the body of the insulating material within the bell. The latter form is probably the best, owing to the much better protection given the insulating material from blows from the trolley wheel and from the weather. The principal advantage claimed for the other form of insulated bolt is that only one portion has to be thrown away in case of failure to work properly.

At curves, the trolley wire is suspended by special pull-off hangers placed sufficiently close to prevent sharp bends in the trolley wire. The usual distance is from 6 to 10 feet, depending, of course, upon the degree of curvature. Where pull-off wires cross the straight line trolley wire, they should be secured to it the same as at the spans. The pull-off wires should all come together in an extra heavy strain insulator at the pull-off pole. It is well at this point to have a turnbuckle capable of tightening the entire series of pull-offs. Care should be taken in all pull-offs and special work to have each and every pull-off wire insulated from its neighbor in such a way that in case of a failure of the pull-off insulation from the trolley to the pull-off wire only one wire will be alive. When this precaution is not taken, it causes a great deal of trouble in locating the leak in a complicated curve.

In iron pole construction the insulation is an important item, first, to prevent leakage to the trolley pole, which not only causes a steady loss but, perhaps, the shutting down of the lines, and also as a matter of safety to the men working on the live trolley wire. It is very disconcerting to a lineman working on a ladder or tower wagon to unexpectedly discover that the span wire, which he thought was insulated, is connected directly to the ground through the pole.

Probably one of the most important matters in trolley construction is the method of suspending the trolley wire from the hangers, and this is especially true on roads where the cars run at a speed exceeding ten miles an hour. The slightest obstruction on the underside of the trolley wire will cause the trolley wheel to leave the wire a short distance to come back again with a sharp blow. Each time the wheel leaves the wire there is an arc formed that takes off a small portion of the wheel or wire. If the obstruction is sufficient the wheel will be thrown so far down from the wire that on its return it will miss the wire and go down the line, striking span wires and special work and straining every part of the overhead construction. This is one of the principal causes of trouble on the line. Probably one of the most satisfactory methods of suspending the wire is by using a bronze or composition ear, 15 inches long, with a groove of the diameter of the wire, milled in the solid of the lower portion of the ear, the depth of this groove to be about the diameter of the wire. The extra portion of the metal is so proportioned that it can be securely hammered down on the trolley wire. The ear should then be carefully soldered, using soldering salts and solder; this, when properly done, makes a first-class job, but there is danger that the wire may be damaged by careless or unskilled workmen. Should the iron be so hot as to partially anneal the trolley wire, there is a very great reduction in tensile strength at the ear, and the wire may be so damaged that on the first strain it will draw out and break. Only the most skilful men should be entrusted with this work, as it requires care and skill that can only be attained by practice.

To give a smooth under-running surface to the trolley wire many devices have been tried. The trolley wire has been rolled in the form of the figure 8 and a mechanical clamp devised to hold the wire in place, giving, theoretically, a smooth under-running surface. Unfortunately the wire in practice is likely to be twisted slightly in the erection and at curves, with the result that the trolley wheel runs on the two loops of the wire, giving extremely unsatisfactory results. To overcome this trouble the section of wire was modified to three points instead of two, and this has been found to work much better. Another plan, of good promise for high speed work, was to take a four naught round trolley wire and with a special machine to press or mill a groove on each side of the wire just above the diameter to fit a clamp. This device answers very well, but it is somewhat difficult to repair work put up in this manner. Another class of suspension involves the use of metal below the trolley wire. Others involve the kinking of the trolley wire. Both of these last-named methods are open to serious objections for high-speed roads.

Another important part in the work is the joining of the trolley wire. This can probably be best accomplished by a long, hard-rolled copper sleeve, about 18 inches long, turned to a cone at each end and so arranged by boring and milling grooves that the wires come out together in the middle of the sleeve. The hole is then soldered and the surplus wire cut off. Another style, without solder, involves some form of clamping device within the tube, the inner chamber being larger than the bore for the trolley wire to enter.

In all special work, such as frogs, cross-overs and section breaks, care should be taken to choose that which gives a clear under-running surface. In high-speed work the tendency is to entirely avoid switches and to substitute for same two trolley wires or cause the trolley to be lowered and placed on another wire on cars leaving the main line. At any speed above ten miles an hour, the chances are greatly in favor of the trolley wheel leaving the wire.

In the early days No. 6 to No. 4 B. & S. gauge wire was considered quite heavy enough for the trolley wire. It was soon discovered, however, that this was entirely too light, and for many years single naught hard-drawn copper wire was used. The tendency is strongly in favor, for standard city work, of the use of double naught wire. It has been proved by experience that the troubles from the

* Read before the Franklin Institute, 1898.

breaking of the trolley wires are reduced to about one-third the number when double naught wire is used. If single naught trolley wire is drawn so tightly that the up and down vibrations only show for three or four poles, the wire is strained well up towards its safety limit and will not stand a sudden and violent blow. The wire should be stretched so that in winter there will be a sag of about 10 inches in every 125 feet. This will make a considerably looser line in summer time.

In deciding upon the size of trolley wire there are several other problems to be considered besides the tensile strength and freedom from accidents. In a network of wires such as here in Philadelphia, the trolley wire is not usually depended upon as part of the feeder system, other than for six or eight cars on a single section. In suburban lines, with comparatively few cars, the question of using the trolley wire as part of the feeder system becomes an important one; and the difference between one naught and two naught trolley, and still more so between two naught and four naught trolley, will determine whether or not a heavy feeder will have to be run alongside of the trolley wire. The cost of bare copper in the form of two naught or four naught trolley is considerably less per circular mil than the cost of a single naught trolley wire plus the necessary insulated feeder wire.

In designing any feeder system the proposed conditions upon which the line is to be run should be very well known, and the line designed for economy of current and original investment for average load, with the provision made that on very heavy loads the voltage will not fall below 375 volts for a few moments. One of the causes of the failure of insulation on iron-pole construction is the effect of lightning discharges on the line, which greatly weaken and strain the insulators, even if they do not break down on the first discharge. To overcome this it is usual to place one of the well-known and tried makes of lightning arrester at each feeder tap, providing it with a kicking coil, and being careful that there be as few bends as possible in the wire to the ground. The lightning arrester should preferably have a single naught tinned wire run down inside of the pole and connected securely to the return circuit and track. The mere grounding of a lightning arrester to a trolley pole set in concrete is not sufficient, as, even on a wet day, there have been cases known where the concrete acted as such a good insulator that there was a difference of potential of 475 volts from pole to track. On wooden-pole construction the problem of insulating is very much simplified, as 18 or 20 feet of wooden pole, properly painted, is probably as good an insulator as can be made. Wooden poles of sufficient weight and of first-class yellow pine, chestnut, oak or cedar, painted with a preservative compound at the butt and painted two coats of good paint, are as satisfactory as iron poles, and in the long run as well as in first cost are a little cheaper. They will last about one-third as long as the estimated life of an average iron pole properly painted.

The limitations to the overhead trolley are now quite generally recognized. It has been found that it is difficult to efficiently transmit by means of the ordinary form of trolley wheel more than 150 amperes from the wire to the wheel without excessive sparking and loss. The speed at which a trolley wheel will stay on the wire, through section insulators, special work and switches, is limited in good practice to not much over ten miles an hour. When the trolley stand and wheel are both designed for high speed and the line carefully constructed it is possible to run on straight-line work at a speed of about thirty miles an hour. Beyond this speed the tendency to throw the wheel from the wire, owing to slight obstructions on the trolley wire, is very great. If the wheel leaves the wire at this speed it is almost certain to either break the trolley pole or bring down a large portion of the overhead construction. It is for this reason that experiments have and are being tried to substitute a fixed conductor near the ground with a large surface contact for the overhead trolley wire for high speed and heavy currents.

A great deal of attention has recently been given to the matter of ground return. It has been found that the current on an imperfectly bonded track is likely to come back to the station through water and gas pipes and on the lead covering of underground cables, setting up electrolytic action, which, in some instances, speedily destroyed the pipes. In bonding a track, the first thing to be considered is to get as low a resistance as possible at each joint. It is also necessary to have an assurance that the bond will remain in perfect condition for a long period of time and will stand the maximum current that will be called upon to go through a special piece of track. The actual cost of the material for bonding a track, with most modern systems of bonding, is a small item compared to the original labor of putting it in place and the cost of re-bonding the track within a few years, without taking into consideration the watts daily lost in the bond circuit. Few persons realize how low a resistance a pair of nine-inch girder rails have, and that every effort should be made to get the full benefit of this return circuit. The resistance of the rail is from six to seven times the resistance of the same section of commercial copper. Very few tracks are bonded more than one-fourth or one-third the carrying capacity of the rail. It has been proved in practice that the earth and fishplates are not to be depended on as part of the return circuit for heavy currents.

The Resistance of the Human Body.

Mr. Dubois, of Berne, presented a note to the Académie des Sciences on the duration of the variable period of current flow when a potential difference is applied to the human body. He used a condenser connected to a battery through the resistance to be compared, and then made the circuit for a very short period by the fall of a steel pencil against a mass of steel. In this way the circuit was broken before the steady state was reached, and by measuring the charge on the condenser one point of the curve of rising pressure could be obtained. From this and the fixed potential difference the period of variable flow of current can be obtained. From comparative experiments, the author concludes that the human body during the period of variable current presents a reactance much smaller than the ohmic resistance. In fact, its capacity partially annuls the resistance. The resistance, however, of the body during the period of variable current is constant. The resistance increases with the length of the parts of the body in circuit, and depends also on the surface of the electrodes. Finally, he concludes that the body acts as a condenser with a liquid dielectric, having a capacity equal to about 0.165 microfarad.

A New Electric Light Station for Cologne.

The Municipality of Cologne has decided to erect a second electric light station, and has voted a sum of $250,000 for that purpose. The present electric light station, which has been running since 1891, has a capacity of 1,600 kilowatts, a lamp connection equivalent to 33,500 50-watt lamps and 600 10-ampere arc lamps, and a motor connection of 427 HP.

Street Railway Men to Meet.

The American Street Railway Association will meet in Boston on September 6, 7, 8 and 9. The Street Railway Accountants' Association will meet in Boston at the same time.

LONDON NOTES.

[From our London Correspondent.]

The Waterloo & City Electric Railway.

This line (underground tunnel, third rail,) is now in full working. On the opening day, August 9, the line was well patronized by the public. The fares are 2d. single and 3d. return. There are no intermediate stations. Each train consists of four coaches, open through, and carrying 240 passengers.

Isle of Man Electric Trams.

There has just been opened a further 10½ miles of electric trolley system in the Isle of Man. The Douglas & Laxey, Laxey & Snaefell and other lines have been so successful that this new line (Laxey to Ramsey) was proceeded with. It opens up a part of the island which has been practically inaccessible to tourists so far.

The Zipernowski & Deri Patents.

The first action to be taken against users of alternating current plant will be prosecuted against the London Electric Supply Corporation. It will be a test case, and if successful Mr. Martin Rucker and the syndicate which has purchased the Zipernowsky & Deri transformer patent rights of 1885 for the remainder of the term will proceed against all municipalities and companies infringing the patents. The Municipal Electrical Association has met in London and resolved to contest the claims to the extremity of going to the House of Lords on appeal if they are defeated in the lower courts. The general opinion is that the courts will not be likely to grant damages or royalties after the patents have been infringed without objection on the part of the patentees for the past ten years. It is hoped in some quarters that the bold front which alternating station owners are putting on will convince Mr. Rucker that his game may not be worth the playing. However, the circulation of his legal letters among the municipalities interested is giving rise to some apprehension, and a few holders of shares in some of the London supply companies display nervousness and are disposing of their holdings.

Multiphase Plant for Manchester.

The Manchester Corporation has a very extensive scheme in hand for supplying the surrounding districts with lighting current from its main generating works. In connection with this scheme the Corporation has just placed a large order for three-phase machinery with Thomas Richardson & Sons of Hartlepool and Brown, Boveri & Co. of Baden. The order comprises rotary converters of an aggregate capacity of 1,200 units with three-phase static transformers of the same type, and also the necessary high and low tension switchboards for the control and regulation of the above. Continuous current will be taken from the omnibus bars of the central station switchboard and transformed by means of the rotary and static transformers to three-phase current at a tension of 5,000 volts. This will be distributed by means of high tension triple conductor cables from the main station at Dickinson street, Manchester, to the different sub-stations, where it will again be converted into continuous current and be distributed to the consumers on the three-wire system with 400 volts between the outers.

CANADIAN NOTES.

The directors of the Bell Telephone Company (Canada) have decided to increase the capital of the company from $3,168,000 to $3,900,000.

Tenders are invited up to August 30 for supplying an incandescent electric lighting plant for the city of Beeton, Ont. Mr. John Galt, C. E. and M. E., is the consulting engineer, and Mr. W. H. Mitchell is the chairman of the electric light committee.

BOOK REVIEWS.

HOW TWO BOYS MADE THEIR OWN ELECTRICAL APPARATUS. By THOMAS M. ST. JOHN, M. E. 140 pages. Price, in cloth, $1.00.

Those who visited the Electrical Exhibition last May cannot have failed to notice on the south gallery a very interesting exhibit, consisting as it did of electrical apparatus made by boys. The various devices there shown, comprising electro-magnets, telegraph keys and sounders, resistance coils, etc., were turned out by boys following the instructions given in the book with the above title, which is unquestionably one of the most practical little works yet written that treat of similar subjects, for with but a limited amount of mechanical knowledge and by closely following the instructions given, almost any electrical device may be made at very small expense. That such a book fills a long felt want may be inferred from the number of inquiries we are constantly receiving from persons desiring to make their own induction coils and other apparatus.

LIGHTING BY ACETYLENE. By WILLIAM E. GIBBS, M.E. 141 pages. Published by D. Van Nostrand Company, New York. Price, bound in cloth, $1.50.

In this work the author defends the use of acetylene gas, gives its history, points out the dangers attending its use, describes its method of manufacture as well as the various types of burners now on the market. The tables at the end of the book giving the United States patents on calcium carbide and acetylene apparatus are not only interesting but valuable. The pages devoted to the rules and regulations of the New York Board of Fire Underwriters regarding the use of acetylene should likewise be found of value. There are some seventy handsome illustrations of calcium carbide works, apparatus and electrical furnaces. The work is unquestionably a valuable one, carefully compiled and apparently dealing with its subject from an unbiased standpoint.

THE TELEPHONE. By WILLIAM J. HOPKINS. 83 pages, bound in cloth. Published by Longmans, Green & Co, New York, London and Bombay.

This little work, as the author states in the preface, explains in detail the principles underlying the action and the design of telephone transmitters and receivers. The book is divided into eight chapters, the first of which explains the action of sound and shows the curves traced by sounding bodies. The second chapter deals with the history of the telephone and is very interesting. Chapter III describes various transmitters and treats of their development, as does Chapters IV, V and VI. Chapter VII treats of magneto instruments. The last chapter is devoted to the discussion of the proper design of receivers. Altogether this little work contains an immense amount of useful information without burdening one with a description of every good, bad and indifferent telephone instrument now on the market.

LEGAL NOTES.

Judge Lacombe in the United States Circuit Court, New York, has granted to the Thomson-Houston Electric Company a preliminary injunction against the Union Railway Company, which is accused of infringing electrical patents. The court found that the company had infringed the 3d, 4th, 14th, 19th, 20th, 23d, 25th, 26th and 27th specifications of U. S. letters patent No. 424,695, said to be owned by the Thomson-Houston Company. The infringing apparatus was furnished by the Walker Company.

Two suits in foreign attachments, aggregating over $26,000, were brought in the Protbonotary's office at Allentown, Pa., on the 11th inst. against the John Stephenson Company of New York, manufacturers of trolley cars. The plaintiffs are William P. Young's Bros., whose claim is $10,372.33, and the Sprague Electric Company of New Jersey, which sues for $16,108.40.

At Pottsville, Pa., on the 17th inst., Judge G. A. Endlich confirmed in a lengthy opinion the verdict of $10,000 damages which a jury last January found against the Schuylkill Electric Railway Company in favor of Elmer J. Walbridge, aged 6 years, who had both hands taken off at the wrist by being run over two years ago on the railway. It is said the car was being run by but one man at the time.

Three applications for receiver for the Citizens' Electric Light & Power Company of Kokomo, Ind., were filed on the 12th inst., with claims aggregating $12,800, by the American Savings Bank of Grand Rapids, Mich., the Capital City National Bank and Joseph L. Cohn of Indianapolis. The corporation is capitalized at $40,000.

The Thomson-Houston Electric Company of Connecticut has filed suit, alleging infringement on patented alternating current motor devices, against the Dayton Fan & Motor Company, Dayton, O., and E. O. Waymire. They ask for an injunction and damages.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILWAYS.

Amherst, Mass.—The directors of the Amherst Street Railway Company are seriously considering the advisability of building an extension from Amherst to South Hadley, which would insure a direct connection between Holyoke and Amherst.

Aurora, Ill.—The projectors of the Aurora, Yorkville & Morris Electric Railway now have matters so well in hand that it is expected work on the line will soon begin. The necessary arrangements are about consummated and the officials think that the first week in September will see construction work started.

Belding, Mich.—A number of Grand Rapids capitalists have organized a company, to be known as the Grand Rapids & Belding Traction Company, for the purpose of building an electric road from Grand Rapids to this city. J. W. Trufant, of Mt. Clemens, has asked the city council for a franchise for an electric road also running from Grand Rapids to Belding. This is a distinct line. Mr. Trufant is backed by prominent Detroit capitalists.

Clayville, N. Y.—At a meeting held here to discuss the subject of an electric railway for the town, 95 per cent. of those present favored the project, and efforts are to be made to secure the building of a road connecting Clayville with Utica.

Defiance, O.—Receiver Faben of the Defiance Light & Railway Company has been authorized by Judge Hubbard to sell the railway property owned by the company. The receiver, it is said, has had an offer from parties who are prepared to buy the road and place it in operation.

Detroit, Mich.—A new suburban railway company has been organized here called the Detroit, Utica & Romeo Railway Company, with $300,000 capital, half paid in, mainly through the efforts of George B. Davis, ex-member of the Legislature from Macomb county. The directors are A. McVittie, Frank E. Kirby, Frank B. Andrus and Elliott G. Stevenson, of Detroit; George B. Davis of Utica, and M. I. Brabb, of Romeo. Bonuses aggregating $45,000 have been subscribed as follows: North Detroit and Romeo, $15,000 each; Utica and Warren, $5,000 each, and Disco and Washington jointly, $5,000. Most of the franchises and right of way have been secured. It is hoped to have cars running by January 1. The motive power will be either electricity or compressed steam.

Durand, Mich.—The village council has granted a franchise to the Long Lake, Durand & Corunna Electric Street Railway Company. By the terms of the franchise the company is to be organized and the work commenced within three months from the date of the franchise, and the road in operation by January 1, 1900. It will run from Corunna through Durand to Long Lake, and from there on to Detroit. Wm. E. Avery of Detroit is at the head of the company.

East Windsor, Conn.—At a meeting of the incorporators of the East Windsor Railway Company to discuss the proposition of George W. Dunham of New York, who has secured the charter of the Springfield & Southwestern Railroad, it was decided to dispose of their charter to Mr. Dunham for a sum that will cover the expense of securing it, etc., on the condition that he will give a written guarantee that he will build the road within a given time.

Elmira, N. Y.—The "Telegram" says: "Parties interested in the Elmira & Seneca Lake Railway Company, which proposes one of these days to lay an electric road from Horseheads to Watkins have been looking over the ground recently and there are rumors in circulation that there is a prospect of the company's soon floating its bonds, in which event it is supposed that work on the road would soon be commenced."

Hudson, N. Y.—The Hudson City Street Railway has been sold to the Brooklyn Traction Company, which has also secured control of the Kinderhook & Hudson steam railroad. The latter will be converted into a trolley road to run in connection with the Hudson City, which is to be extended to Philmont, and it is said the road will in time run to Nassau, thence to Albany, and finally connect with Troy and Cohoes. The consideration for the franchises and property is placed at $500,000.

Kansas City, Mo.—The "Journal" states that the Jackson County Railway Company, which will be incorporated at once with a capitalization of $100,000, with F. W. Sears as the president, a few days ago made application in the county court for franchises for two lines of electric railway, one to follow Independence avenue from the eastern limits of the city and the other from the southern city limits to Dodson. It is understood that those associated with Mr. Sears are Kansas City men, and that the purpose of the company is to establish cheap fare roads to the suburbs of the city with which they will connect.

Lawrence, Kan.—T. A. Allen, the engineer in the employ of the promoters of the electric railway, is at work on maps showing the routes that will be feasible for the new road to use. The plans for the power house have been completed and are in the hands of the men who will build the road.

Milwaukee, Wis.—General Manager Beggs of the Milwaukee Railway Company says the long-talked of Milwaukee and Chicago electric railway line needs only the building of the connecting link between Kenosha and Waukegan to complete it. This line will soon be built.

New York.—The Metropolitan Street Railway Company is said to be contemplating an extension of its electric railway system to Seventh avenue from the northern end of Central Park to the Harlem River.

Portland, Ind.—The contract for an electric railway between Redkey and Dunkirk has been awarded to the Electrical Installation Company of New York and Chicago, and work is to be commenced at once. The line will probably be extended to Pennville.

San Francisco.—Ground has been broken here for what will probably be the shortest electric railway in the world. The road is to be only half a mile in length and will run on San Bruno avenue from the San Jose road to Mount Olivet cemetery. Only one car will be used, and a transfer arrangement has been made with the San Mateo Railway. The directors of the new road are also the directors of the Mount Olivet Cemetery Association.

Wichita, Kan.—The city council has extended the franchise given to W. Q. Church of New York for a street railway in this city. The time of the original franchise granted to Mr. Church expired some time ago, and he had some difficulty in getting an extension, but finally succeeded. He has deposited $10,000 in the city treasury as a guarantee that the road will be completed by March, 1899.

LIGHTING PLANTS.

Arlington, Ga.—The city council has under consideration a petition for an election to determine the question of issuing bonds for the establishment of waterworks and an electric light plant.

Brooklyn, N. Y.—Deputy Commissioner Walton of the Department of Public Buildings, Lighting & Supplies is completing arrangements to have a meter and light testing bureau in Brooklyn. The charter provides that all meters be regularly tested and also the gas and electric light furnished the city, so that the proper candle power may be insured.

Cleveland, O.—The Consumers' Electric Company is the name chosen by the promoters for the proposed organization which is intended to enter into competition with the Cleveland Electric Illuminating Company on the West Side. The nominal capitalization of the company is $30,000, and the officers of the preliminary organization are A. W. Oppman, president and treasurer; John Meckes, vice-president, and Charles P. Salen, secretary.

Lansdowne, Pa.—Application has been made for a charter for the Lansdowne Electric Light Co. which purposes to furnish light, heat and power to this borough and vicinity. The incorporators are Tamany P. Street, Henry C. Staatzel, Richardson Shoemaker, J. Milton Lutz and Murtha J. Kelly.

Mansfield, Pa.—The Mansfield Electric Company has submitted to the council a proposition to light the streets of the borough with 16 CP. incandescent lights at $10 per lamp a year.

Medway, Mass.—The new electric light company has organized with John McGuinnes president, Clark P. Harding secretary, and the following directors: Charles H. Dean, John D. Shipper, George Harding and Daniel S. Woodman. The company will light the streets of the town beginning September 15.

Orangeburg, S. C.—A meeting will be held here at an early date to discuss the questions of waterworks and electric lights.

San Bernardino, Cal.—B. C. Roos, the former manager f the electric plant, has had plans prepared for an

electric and gas plant which he proposes to establish on a basis that will make lights one-third the present rate. The motive power for generating the electricity is to be steam.

South Amboy, N. J.—J. A. Carr of Hackettstown has made application to the borough council for a franchise to operate an electric light and heating plant in South Amboy, and an ordinance has been framed for the action of the council at its next meeting.

Tallahassee, Fla.—There is talk here of putting in an electric light plant at the expense of the taxpayers. A citizen has been getting estimates for a plant with a capacity for 100 arc and 3,000 incandescent lights and the outside figures were $12,000.

Watertown, S. D.—O. M. Kirlin and others have been granted a franchise for the erection of an electric light plant in Watertown. The plant will be entirely new and up to date.

MANUFACTURING, ETC.

Dixon, Ill.—The Dixon Power & Lighting Company are putting in two Leffel turbine wheels at their recently purchased property on the river. The turbines are guaranteed 114 HP. each with a six foot head of water. The company are making several improvements in their plant, including a new 240 HP. generator for arc and incandescent lighting, and will supply power for the shoe factories of Henderson & Co., and for other manufacturers.

Hartford, Conn.—An electric carriage built by the Pope Manufacturing Company was awarded the first prize for elegance at the special automobile meet recently held at Spa, Belgium.

Philadelphia.—Application will be made to the Governor of the State on September 5 by Albert G. Davids, Wilson Pierson, William J. Greer, Howard R. Penrose and George E. Scuse, under the Act of Assembly of the Commonwealth of Pennsylvania, entitled "An Act to provide for the incorporation and regulation of motor power companies for operating passenger railways by cable, electrical or other means," approved March 22, 1887, for the charter of an intended corporation, to be called the Southwestern Traction Company of Philadelphia, the character and object of which is the construction and operation of motors and cables or other machinery for supplying motive power to passenger railways and the necessary apparatus for supplying the same.

Pittsburg, Pa.—The "Times" of the 15th inst. states that the Westinghouse Electric & Manufacturing Company has just concluded the contract for the installation of the complete electric equipment for the Snowqualmie Falls Power Company's big plant at Snowqualmie Falls, Wash. The first installation will be for 10,000 horse power and 20,000 horse power will soon be added. The president and principal owner of the Snowqualmie Company is William T. Baker, of Chicago, who was the first president of the World's Fair Commission.

San Francisco.—The Fort Wayne Electric Corporation and the Tuthill Water Wheel Company have shipped by vessel from this port the first electric lighting and power apparatus ever sent from this city to South America. It is for the Yanni Development Company, which is controlled by the Rothschild syndicate in London. Up to this time all mining equipment has been sent there from London and Germany. The machinery will be landed in Peru and sent overland 600 miles to the mines in the Andes beyond Lake Titicaca in Bolivia.

Washington, D. C.—The Navy Department is inviting sealed proposals until August 30 for two pairs of runways, erected on foundations in building No. 20, Brooklyn Navy Yard, together with lateral bracing and two electric traveling cranes of 20,000 pounds lifting capacity, with three motors each, for lifting and traversing the same with loads. The crane will be operated by means of electricity, having an independent motor for each motion, hoisting, traverse and longitudinal traverse, operated from the floor and receiving the current from wire and trolley arranged at the ends. Intending bidders desiring specifications, blank forms of proposals and other information can obtain the same upon application to the Navy Pay Office at New York, or to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

TRANSMISSION PLANTS.

Colorado Springs, Col.—At noon on the 17th inst. Governor Adams turned on the electricity by which hereafter the gold mines of Cripple Creek will be run and lighted. Steam will be entirely replaced in all the leading mines by electricity generated at Canon City, twenty-four miles south of the camp. The first mines in the district to receive the benefit of this potent power will be the Trilby, operated under lease by Tabor & Ferguson, the workings of the old Bird & Gill lease on the Wisconsin, and the Dustline & Miller lease on the same property. At these mines electric hoists have been put in, while other properties are still awaiting the arrival of the electric equipment, delayed in the Eastern factories through demands due to the war.

Dumont, Col.—The electrical power plant that is under way for this place will somewhat revolutionize power in this camp. The tunnels, mills and mines are to be supplied with electric power, and drills will be operated by electricity instead of air. It is the intention also to put in steam power, to be used during the low stages of the creek. The company is organized in Ohio and has at its head some of the wealthiest men of Cleveland. One of their number has been here examining the outlook and he is highly gratified with the showing. Water rights have been secured along Clear Creek for two miles, in addition to the acquiring of ground near Empire for the storage of water.

Lockport, N. Y.—On the 10th inst., electric current generated at Niagara Falls was brought to this city by way of Tonawanda and lighted the Buffalo & Lockport Electric Railroad Company's power house here. The distance over the wires is about 30 miles.

Mechanicville, N. Y.—The immense plant of the Hudson River Power Transmission Company, which has been in process of building for more than a year, is now finished and power is being furnished therefrom. The dam of this company is, it is stated, one of the finest in the world. In length it measures about 2,000 feet; its central part rests upon a rocky island and it is 18 feet high. The dam is situated about two miles below the village of Mechanicville. It is built of concrete; at the end of the dam heavy piers of concrete of a circular plan are anchored securely to the shore. The plan, as prepared by the chief engineer, called for seven dynamos, but only five have been installed. These generators are of the General Electric three-phase type. Four turbines, each forty-two inches in diameter, are mounted on each shaft for the operation of a dynamo. Under the conditions of operation the wheels, which will work under a head of 18 feet of water, are expected to develop 250 horse power each. It is expected that power will be distributed to Albany, Troy and many other towns and cities near Mechanicville. The power house is a large brick building with heavy steel beams, an iron roof and concrete floor. The first floor is devoted entirely to the dynamos and their appurtenances, while the second floor, which is on a level with the dam, is given up to offices. The dam has caused the water to overflow nearly fifty acres on the east side. On the north side of the building a broad walk leads to Bluff Island, which supports the center of the dam. This new enterprise has attracted much attention and many visitors have been in attendance during its construction. The General Electric Company will use 2,000 of the 6,000 horse power of the plant. Several surrounding cities will undoubtedly make application for power in the near future.

Porterville, Cal.—W. H. Hammond has returned from England, where he went to obtain financial backing for a scheme to develop electrical power in Tulare county. He claims to have been successful and is making contracts to furnish power for irrigation and other purposes. The plant will be established twenty-nine miles east of Visalia on the Kaweah River. The cost of putting in the plant and extending the system to Visalia, Tulare, Porterville and Lindsay is estimated at about $250,000.

COMPANY MATTERS.

San Antonio, Tex.—John H. Clark of this city has been appointed receiver of the West End Street Railway Company. The appointment was made by the court upon the application of the bondholders.

New Haven, Conn.—The stockholders of the New Haven Street Railway have authorized the board of directors to purchase the New Haven & East Haven River Railway. The purchase will be provided for by a bond issue of $100,000 at 5 per cent. in the nature of a first mortgage on the new property. Bonds to cover a second mortgage will also be issued and a new issue of stock is also under consideration.

PERSONAL AND MISCELLANEA.

Several conductors of the Citizens' Street Railway in Detroit have been arrested for using bogus tickets on their cars and pocketing the proceeds of their sale to passengers. The Detroit detectives believe that the bogus tickets are manufactured in Chicago and circulated by an organized gang.

Electricity is being substituted for steam power in turning the city's bridges at Chicago. The new Fullerton avenue bridge is the latest to be thus equipped. During the season Rush, State, Dearborn, Clark, Wells, Lake, Randolph, Washington, Adams, Jackson and North Halsted street bridges have been equipped with new machinery at a cost varying from $600 to $1,000 each. The Van Buren street bridge has been operated by electricity since its construction. Power for the electric machinery is taken directly from the trolley wires of the street-car companies crossing the bridges, and only the amount used is paid for.

Thomas Nevins, a retired New Jersey street railway magnate, who went to Ireland on a visit two years ago and while there purchased Killeen Castle, returned to his former home in Orange last week for a four months' stay. While abroad Mr. Nevins secured a trolley franchise in Cheltenham, Eng., and a short time ago he purchased Mount Shannon Castle, the seat of the Earl of Clare. This is larger than Killeen Castle, and is situated in the county of Limerick, about three miles from the city of that name. The residence contains sixty apartments, and there are stables, farmyards, outoffices, stewards' and gardeners' houses, kitchen gardens and pleasure grounds. There are 1,000 acres in the place. The three coach houses on the place have stalls for thirty-five hunting horses, and the cattle house will accommodate 1,000 cattle. Five acres of the estate are walled in for tilling. A private gas works adjoins the house, and there is an abundant supply of water. The woods are filled with ancient growths of beech, oak, larch, sycamore and elm and stocked with plenty of game and wild fowl.

Henry L. Harris, a great-grandson of John Harris, the founder of Harrisburg, Pa., died at his home in that city on the 16th inst. He was for years an expert telegrapher, but was stricken with paralysis a few years ago. He was in his 61st year. He was manager of the Western Union Telegraph Company in Harrisburg for several years. During the Civil War he had charge of the telegraph lines between Baltimore and Washington, and also had headquarters at Gettysburg previous to and during the battle. Later he was sent to Philadelphia and was one of the first four operators employed in the Quaker City by the Western Union Company. He was the first operator to receive a message by sound in Harrisburg.

The superstition that human beings should sleep with their heads to the north is believed by the French to have for its foundation a scientific fact. They affirm that each human system is in itself an electric battery, the head being one of the electrodes, the feet the other. Their proof was discovered from experiments which the Academy of Science was allowed to make on the body of a man who was guillotined. This was taken the instant it fell and placed upon a pivot free to move as it might. The head part after a little vacillation, turned to the north, and the body then remained stationary. It was turned half-way round by one of the professors, and again the head end of the trunk moved slowly to the cardinal point due north, the same results being repeated until the final arrestation of organic movement.

RECENT COMPANY ELECTIONS.

Bangor & Oldtown Street Railway Company, Bangor, Me.—President and general manager, Elias Milliken; treasurer, John Cassidy of Bangor; clerk, A. J. Durgin of Orono.

Boston Electric Light Company, Boston, Mass.—President, F. A. Gilbert; vice-president, E. B. Maltby; clerk and treasurer, Samuel S. Silas; general manager, F. A. Gilbert; directors: the officers and Charles L. Lovering, Dexter N. Richards, William Butterfield, Charles Lowell, E. W. Burdett, William A. Paine; executive committee: F. A. Gilbert, Charles L. Lovering, Charles Lowell.

Brattleboro Street Railway Company, Brattleboro, Vt.—Directors: E. L. Waterman, H. L. Emerson, J. P. Sargent, S. S. Hunt, C. A. Smith. O. K. Jones was re-elected superintendent.

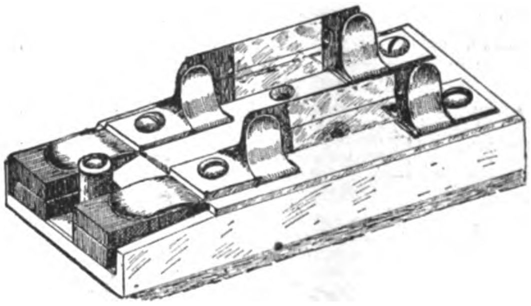
Toledo, Bowling Green & Fremont Electric Railroad Company, Toledo, O.—President, Edwin Jacoby, vice Frank J. Hoag resigned.

COMMERCIAL PARAGRAPHS.

A New Combined Fuse Block and Lightning Arrester.

The Telephone Department of the Electric Appliance Company, Chicago, has just placed upon the market a Combined Fuse Block and Lightning Arrester. It is an article of merit and will demand the attention of telephone exchange managers. It is $4\frac{1}{4}$ inches long by $1\frac{1}{4}$ inches wide. The illustration herewith gives a very fair idea of its appearance.

Absolute protection is secured from burn-outs from crosses caused by trolley and electric light lines breaking and falling across the telephone wires. It is a positive



lightning arrester and is practically indestructible. It requires no attention.

The effect of a lightning discharge across the carbon blocks is that of producing a small amount of carbon dust. This can easily be removed by pulling out the carbon blocks and blowing out the dust, then replacing them, and the arrester is in working order again.

The fuse end of the arrester should always be connected to the wires running to the instrument to be protected and the carbon arrester end directly to the line wires.

The lightning arrester, part of the block, is constructed with two carbon blocks, with perforated mica separating them. One block rests on the ground plate and the other is connected directly on the line, the idea being to produce an arrester on the air gap principle.

The perforations in the mica separator produce this result when the carbon blocks are placed in their proper position on the arrester.

The fuse portion of the arrester can be furnished with either the Postal or Western Union type terminals, an ordinary two-inch copper or foil terminal fuse being used. The base is made of porcelain.

INCORPORATIONS.

The Morrow Power & Electric Light Company, Morrow, O. Capital stock, $10,000.

The H. W. & M. Electric Company, New York. Capital stock, $25,000. Directors: Charles Hagedorn, Brooklyn, and two others.

The Perry Electric Light, Heat & Power Company, Newport, Pa. Capital stock, $18,000. Incorporators: A. D. Van Dyke and S. S. Leiby, Marysville; J. K. Van Dyke and John H. Smith, Philadelphia, and J. S. Leiby, Newport.

The Dunkirk & Redkey Traction Company, Dunkirk, Ind.—to build an electric railway connecting the two towns named in the title and others in Jay County. Capital stock, $75,000. Incorporators: H. C. Billingsly, Chas. A. Hanable, R. E. Hasbrouck, Elmer Bishop and W. H. Keyser.

The Rochester & Sodus Bay Railway Company, Rochester, N. Y.—to operate by electricity, compressed air or other power except steam, a railway line, 41 miles long, from Sodus Point to Rochester. Capital stock, $1,000,000. Directors: George E. Merchant, Walter B Duffy, Thomas J. Nicholl, Daniel G. Clapp, George Wilder, A. Master McDonnell, Joseph C. Gone, Ira M. Luddington, George Wilson, Charles Van Voorhis, Rochester; John A. Sullivan, New York.

The Keeseville Electric Company, Keeseville, Essex County, N. Y. Capital stock, $30,000. Directors: Orville S. Moore, H. M. Prime, A. W. Boynton, Keeseville; H. E. Barnard, Plattsburg; George F. Morse, Peru.

The Loveland Power & Electric Light Company, Loveland, O. Capital stock, $10,000. Incorporators: I. W. Newcomer, C. C. Stickelman, W. H. Stubbs, H. A. Coyne and R. B. Corwin.

ELECTRICAL PATENT RECORD.

Letters Patent Issued August 16, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

609,048. Motor-Car. Charles O. Palmer, Cleveland, O. Filed April 18, 1894. Renewed Jan. 25, 1898.
609,124. Electric Brake. Ernest B. Skinner, Ogden, Utah. Filed Oct. 30, 1897.
609,188. Electrical Traction. William Kingsland, Llandudno, England. Filed Dec. 23, 1897.
609,252. Electric Rail-Bond. Joseph S. Tucker, Chicago, Ill. Filed Jan. 20, 1897.
609,292. Switch and Switch-Operating Mechanism. James P. Orr and George H. Fugh, Pittsburg, Pa. Filed Nov. 9, 1897.
609,206. Car-Fender. Anton Mazzanovich, New York City. Filed Dec. 8, 1897.
609,394. Car-Fender. Timothy A. Remsen, New York City, assignor to Henry M. Lee, same place, and Mary E. Remsen. Filed Dec. 15, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

609,092. Electric Controller. Joseph D. Forrer, Johnstown, Pa., assignor to the Steel Motor Company of Ohio. Filed July 11, 1898.
609,245. Electrical-Circuit Controller. Nikola Tesla, New York City. Filed Dec. 2, 1897.
609,246. Electric-Circuit Controller. Nikola Tesla, New York City. Filed Feb. 28, 1898. 609,247, 609,248 and 609,249, ditto. Filed March 12, 1898.
609,250. Electrical Igniter for Gas-Engines. Nikola Tesla, New York City. Filed Feb. 17, 1897. Renewed June 15, 1898.
609,251. Electric-Circuit Controller. Nikola Tesla, New York City. Filed June 3, 1897. Renewed June 15, 1898.
609,274. System of Control of Electric Motors. Edwin R. Gill, Englewood, N. J., assignor to the Invention Development Company of New Jersey. Filed April 4, 1898.

ELECTRIC ELEVATORS.

609,015. Electric Elevator. Rudolf Eickemeyer, Yonkers, N. Y. Filed Jan. 5, 1891.
609,016. Electric Elevator. Rudolf Eickemeyer, Yonkers, N. Y. Filed May 3, 1892.

TELEPHONE AND TELEGRAPH APPARATUS.

609,154. Electric Telegraphy. Oliver J. Lodge, Liverpool, England. Filed Feb. 1, 1898.
609,178. Telephone System. Alfred F. Swan, Bayonne, N. J. Filed Sept. 29, 1897.
609,229. Telephone System. Charles E. Egan, Burton L. Lawton and Ernest O. Wilcox, Meriden, Conn. Filed April 9, 1897.
609,331. Telephonic Measured-Service System. William W. Dean, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Nov. 16, 1897.
609,374. Telephone Repeater or Relay. John S. Stone, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Dec. 29, 1897.

BATTERIES.

609,142. Combined Battery and Electric Cell. Jules C. Dagoneau, Beaufort, France. Filed Jan. 15, 1895.
609,298. Primary Battery. Walter Rowbotham, London, England. Filed Feb. 24, 1898.

MISCELLANEOUS.

609,094. Method of and Apparatus for Making Electrical-Insulation Conduits. Hugo Gallinowski, St. Louis, Mo., assignor to the Lithosite Manufacturing Company, same place. Filed Nov. 15, 1897.
609,288. Means for Fastening Insulator-Pins to Cross-Arms. Loron Mitchell, Augusta, Ga. Filed May 10, 1898.
609,356. Electrical Conduit Box. Hubert Krantz, New York City. Filed May 6, 1898.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

TELEPHONE AND TELEGRAPH.

In an article on "Telegraphy and the War," the Washington *Post* says: "The telegraph system has become so perfect that the record of every operator in the service is immediately accessible to any manager of any office of any company. Should a telegrapher apply for work he would be required to fill out a blank, giving the name of his first employer, a list of the different offices in which he had worked and the reasons for having left his last place. The applicant is told to come back in an hour, at the end of which time the manager knows whether his record is clear or not. The enormous increase of telegraphic business as a result of the war brought numerous men of the 'hobo' genus to Washington. Some of these men are really expert telegraphers, but upon whom the whisky demon has fastened his grip. They are perfectly trustworthy as far as office secrets are concerned, and they do good work as long as they abstain from liquor, but sooner or later they give way to their craving for drink and are dismissed, to go to some other office, where they may be employed in an emergency, until they again fall before the tempter. An absolutely correct record is kept of such men, and it would be impossible for one of them to deceive a manager to whom he might apply for employment. There have been scores of them in Washington since the outbreak of the war, but they have gradually weeded themselves out, until to-day both of the great telegraph offices at the capital are manned by men who are as reliable in their habits as in their skill."

The Philadelphia Standard Telephone & Telegraph Company and the Chestnut Street Trust & Saving Fund Company have filed affidavits of defence in the suits brought against them, as principal and surety respectively, by the city of Philadelphia to recover on two bonds of $50,000 each, given as security that the Standard Company would put in operation a telephone system within a year from the date of approval of the company's plans, July 22, 1896. The defendants aver that all of the provisions of the ordinance were faithfully performed except that owing to the doubtful validity of the bonds issued and the inability to raise money on them it was found impossible to build the plant in the prescribed time. It is then contended that the sum of $50,000 named in the ordinance and in the bond upon which suit is brought is a penalty and not a sum named as liquidated damages; that the statement of claim is defective and insufficient to entitle the plaintiff to judgment, for the reason that the items making up the aggregate $50,000 alleged damage to the city are not set forth, and there is nothing in the statement to show the character of the injury done to the city or anything to show how a failure to supply the citizens with telephones has caused an injury of $50,000 to the city in its corporate capacity.

Representatives of the various companies in the Iowa Telephone Association, which embraces most of the independent lines, met recently in the Commercial Exchange rooms at Des Moines and revised the toll rates which have been in operation to the present date. The companies were represented as follows: Central Telephone Company —H. E. Teachout, J. W. Hill and M. McFarlin; Perry Telephone Company—Geo. N. Bandy; Jefferson Telephone Company—C. G. Cockerell; Spirit Lake Telephone Company—W. W. Pritchard; Boone Telephone Company—O. E. Wells; Marshall Telephone Company—W. G. Boone; Clearfield and Mt. Ayr Telephone Company—D. N. Smith; E. H. Martin Telephone Company—E. H. Martin; Conway Telephone Company—G. A. Haynie; Knoxville Telephone Company—J. S. Bellamy; Chariton Telephone Company—Mr. Stuart; Morovia Telephone Company—Mr. McFatridge; Hawkeye Electric & Commercial Company—C. W. Bartlett. The main feature of the revised tariff sheet is the fact that tolls will be based hereafter on mileage rather than the number of counties through which a message passes. The former plan worked very inequitably.

At Durham, N. C., when the Interstate Company, a local organization, began putting up a system, the Bell company gave a free service and continued to do so for about two years. In spite of this fact the new company was a success at regular rates. The Bell company has now taken another tack and issued a schedule of rates to correspond with those of the Interstate, and is making new efforts to regain its patrons, but the people of Durham are not in a humor just now to give the Bell system a very hearty endorsement, especially when the life of a home enterprise is at stake and after the treatment they have received.

A new telephone company has been organized at Aberdeen, S. D., under the name of the Central Dakota Telephone Company. It will build and operate a telephone line from Brookings to Pierre, with side lines branching out to all towns of any importance on either side.

A Spartanburg, S. C., correspondent writes: "The Home Telephone Company is moving ahead. Their organization has been completed and they will begin work at an early day. They have 200 to 300 subscribers here, who bind themselves to take these home 'phones five years to the exclusion of the Bell 'phones. They expect to begin with their service by the first of the year."

The opening of the new French cable between Havre and Cape Cod last week was marked by very friendly messages between President Faure and President McKinley and between the presidents of the Chambre de Commerce de Paris and the New York Chamber of Commerce. This line, which runs direct from America to France, is the longest and most expensive submarine cable ever laid. All other lines from America to France have relaying stations on British territory.

The North Park Telephone Company has filed incorporation papers with the Secretary of State at Denver, Col. The company has been formed to operate a principal telephone line between the town of Walden, in Larimer county, Colorado, and the city of Laramie, in Albany county, Wyoming, with branch lines to be established later.

The Mankato Citizens' Telephone Company has awarded the contract for installing a 200-'phone plant in Mankato, Minn., to H. M. Kellogg, for about $7,000. The contract is to be completed within ninety days. The stock of the company has been entirely subscribed by Mankato citizens, and important connections are to be made with other lines running north and south.

A local company on the plan of the Delmarvia Telephone Company has been organized in Reading, Pa., and has applied to the city council for a franchise. The members of the new company investigated the workings of the Delmarvia system at Wilmington, Del., and were apparently well pleased with it.

The Standard Telephone Company has completed its line from Kansas City to Marshall, Mo. The line will be extended to Cooper County and finally by way of Sedalia from Higginsville through Southwest Missouri and to St. Louis along the Missouri Pacific Railroad.

The Massillon, O., *Independent* says: "The Bell Telephone Company, which is now building metallic circuit toll lines to Canal Fulton, Clinton, Nimisila and other places west of the city, is preparing to extend its lines south through Richville, Navarre, Beach City, Wilmot and Justus."

The Oneida Telephone Company has brought suit against the Central New York Telephone & Telegraph Company for refusing to set up one of its instruments in the office of the Oneida Company's superintendent.

Lexington, Miss., is to have a telephone system, the result of the efforts of some of its young business men. The capital stock has been subscribed and thirty-eight subscribers secured.

The Des Moines Mutual Telephone Company will complete the first year of its existence on October 1.

New Companies Incorporated.

The Perry County Telephone Company, DuQuoin, Ill. Capital stock, $12,000.

The Midland Telephone Company, Adrian, Minn. Capital stock, $50,000. Incorporators: Dan Shell and others.

The Albuquerque-Bland Telegraph & Telephone Company, Albuquerque, N. M. Incorporators: Wm. T. Powers, B. Brooks, J. J. Dickey and A. L. Conrad.

The Trans-Mississippi Telephone Company, Omaha, Neb. Capital stock, $10,000. Incorporators: William B. Douglas, Warren P. Carlisle and W. P. Lathrop.

The Mountain Home & West Plains Telephone Company of Arkansas, West Plains, Mo. Capital stock, $5,000; capital to be assessed in Missouri, $450.

The People's Telephone Exchange, New Richmond, Wis. —to establish a telephone exchange in New Richmond. President, Charles N. Gorham; vice-president and manager, A. J. Presson; secretary, Wm. Hughes; treasurer, Dr. Epley.

The Telephone Information Company, Limited, East Orange, N. J.—to gather and distribute information of all kinds by means of electrical contrivances. Capital stock, $125,000, of which $1,000 is paid in. Incorporators: Henry B. McDowell, Howard K. Wood and Duncan T. McLaren, all of East Orange.

The Maryland Telephone & Telegraph Company, Baltimore—to operate lines in Frederick, Washington, Allegany, Garrett and Montgomery counties, Maryland; Adams and Franklin counties, Pennsylvania, and Loudoun county, Virginia. It is the intention of the company to purchase the interest of the Interstate Telephone Company which now conducts the principal telephone system in Frederick. Capital stock, $30,000.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Aug 22:						
Albany Ry. Co	100	2,000,000	$1,750,000	1¾ % Q., Feb. '98.	145	150
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	69	70
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown, Pa.—Aug 22:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Aug. 22:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	35	..
Baltimore, Md.—Aug 22:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '97.	..	72½
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., Jan. 15, '98	23⅛	23⅜
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897	80	82½
Boston, Mass.—Aug 22:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97	...	..
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	10½	12
North Shore Traction Co.........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	76	78
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	87¼	87⅜
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	...	105½
Boston Elevated R. R.	100	10,000,000			68½	
Brooklyn N. Y.—Aug 22:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	68⅛	68⅜
cBrooklyn Heights Railroad	...	200,000	200,000	....	..	..
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	212½	214
eBrooklyn, Queens Co. & Sub. RR.	...	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	200	..
Kings County Elevated	...	4,750,000	4,750,000	....	2½	6
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	...	6,000,000	6,000,000	....	..	...
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	...	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Aug 22:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	55	60
*Buffalo Railway Co	100	6,000,000	5,370,500	1 % Q. Dec., '97.	80	81
Columbus O.—Aug 22:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb., '98.	49	50
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Aug 22:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Aug 22:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	280	290
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	13¼	13½
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	2
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan., 98.	216	218
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	93	..
jChicago West Div. Ry.......guar.	...	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Aug 22:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry.........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	114¼	114½
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Aug 22:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	87	89
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '97.	62½	63
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '97	60	61
Detroit, Mich.—Aug 22:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	...	250,000	250,000	....	..	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Aug 22:						
City Railway Co..............com.	100	1,500,000	1,470,600	1¼ % Q., Jan. 1,'98.	100	102
City Railway Co.................pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	150	155
People's Street Railway	...	1,100,000	....		100	..

* Unlisted. † Ex div.
a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
b Leased to Boston Elevated Railroad Company.
c Owned by Brooklyn Rapid Transit Company.
d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.
e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR
g Owned by Atlantic Ave. RR. and leased to Nassau system.
h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.
i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.
k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Aug 22:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	4 % S., Jan., '98.	140	–
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	–
Holyoke Mass.—Aug 22:						
Holyoke Street Ry. Co	100	400,000	400,000	4 % A., Jan., '98.	180	190
Hoboken, N. J.—Aug 22:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	–
Indianapolis, Ind—Aug 22:						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	27	30
Lancaster, Pa.—Aug 22:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	..
Lancaster & Col. Electric Ry	...	....	87,500	....	..	..
West End Street Railway	...	....	....	....	..	..
Louisville, Ky.—Aug 22:						
Louisville Ry..................com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	34	39
Louisville Ry..............5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	96	100
Minneapolis, Minn.—Aug 22:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	18	23
Twin City Rapid Transit....7 % pfd.	..	3,000,000	1,714,200	1¾ % Jan., '98.	..	100
Montreal, Canada.—Aug 22:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	274½	276
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	100	100½
Memphis, Tenn.—Aug 22:						
Memphis Street Railway Co	100	500,000	500,000	....	15	–
New Haven, Conn.—Aug 22:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—Aug 22:						
Canal & Claiborne RR. Co	10	240,000	240,000	4 % S., Jan., '98.	146	170
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	1½	2
New Orleans Traction Co........pfd.	100	2,500,000	2,500,000	....	6½	8¼
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	32
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	85	88
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	18	22
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	53	54½
New York—Aug 22:						
Central Crosstown RR	100	600,000	600,000	2½ % Q., July, '97.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Jan., '98.	150	160
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98.	170	190
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Jan., 98.	159½	160½
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	32	34
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	210	220
gCen. Park, N.&E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98.	180	..
hEighth Avenue RR	100	1,000,000	1,000,000	....	320	..
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q., Feb., '98.	340	360
jNinth Avenue RR.........guar.	100	800,000	800,000	....	170	180
kSixth Avenue RR............guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q. Feb., '98.	330	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., Jan., '98.	178	181
Third Avenue RR	100	12,000,000	10,000,000	2 % Q., Feb., '98.	170	175
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	58	62
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Aug 22.						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	51½	52
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Aug 22:						
Allegheny Traction Co	50	500,000	500,000	....	...	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	16½	16⅝
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	53¼	53¾
pCentral Traction Co	50	1,500,000	1,900,000	....	...	...
qCitizens' Traction Co	50	3,000,000	‡3,000,000	6 % A.	63	...
rDuquesne Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	..	...
Federal St. & Pleasant Valley Ry.	25	1,100,000	1,400,000	2½ %, Jan., '98.	..	24½
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	‖2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	21½	...
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 97	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

* Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.
a Leased to New Orleans Traction Company at 6 % on stock.
b Leased to New Orleans Traction Company at 8 % on stock.
c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.
d Operating the former Met. Trac. system, that corporation having become extinct.
e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum
i Leased to Metropolitan Street Railway for 18 % on stock.
j Leased to Met. St. Ry. for 99 years from April 20, 1892; 7 % first 5 years, 8 % thereafter
k Leased to Metropolitan Street Railway for $145,000 per annum.
l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
m Controlled by Third Avenue Railroad by purchase.
n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.
o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co
p Leased to Consolidated Traction Company for 8 % per annum on par value of stock
q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.
r Leased to Consolidated Traction Company for 4 % on capital stock after October,
s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Aug 22						
Union Street Railway Co	100	$350,000	$350,000	2 %, Feb. '98.	...	158
Northampton, Mass—Aug 22						
Northampton Street Ry	100	300,000	225,000	4 % A., Jan., '98.	168	175
Omaha, Neb.—Aug 22:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Aug 22:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	85	86
Providence, R. I.—Aug 22:						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	60	64
Philadelphia.—Aug 22:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14⅛	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	43½	45
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98	65⅝	66
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	65	66
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450	....	21⅜	21½
cElectric Traction Co	50	....	8,297,920	....	71⅛	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	390	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	256	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	185½	..
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	9⅜	91½
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	142½	..
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	175	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90¼	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	288	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖835,000	$11 sh. A., July, '98	275	...
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.—Aug 22:						
Rochester Railway Co	100	5,000,000	5,000,000	....	9	12
Reading, Pa.—Aug 22:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	64	..
St. Louis Mo.—Aug 22.						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % July, '98.	126	128
National Railway Co	..	2,500,000	2,479,000	1½ %, July, '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '98.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	800,000	50c., Dec., '89.	..	..
Southern Electric Ry.........com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	110	112
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	58	55
Union Depot RR	100	4,000,000	4,000,000	8 % A., July, '95.	..	175
San Francisco, Cal.—Aug.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	107	108
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅝	53¾
Presidio & Ferries RR	100	1,000,000	550,000	....	...	8½
Scranton, Pa—Aug 22:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
m Scranton & Carbondale Trac. Co.	100	500,000	500,000	....	..	18
m Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Aug 22:						
Springfield Consolidated Ry	100	750,000	750,000	....	—	11
Springfield O.—Aug 22:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—Aug 22:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—Aug 22:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	100	100½
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	274½	276
Washington, D. C.—Aug 22						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	78⅛	75
Columbia Ry. Co	50	400,000	400,000	6 % A.	76½	78
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	121	123
Worcester, Mass.—Aug 22:						
*Worcester Traction Co.......com.	100	8,000,000	8,000,000	....	15	17
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	8 % S., Feb., '98.	91½	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Aug 22:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1 %, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation (Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 22:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., July, '98.	282	284½
Erie Telegraph & Telephone Co	100			1 ½ Q., Jan. '98.	74	75
New England Telephone Co	..	10,894,600	10,894,600	$1.50 %, Feb. '98.	144	..
New York.—Aug 22:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	95	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	104	105½
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	180	185
Franklin Teleg. Co......2½ % guar.	100	1,000,000		1¼ % S.	40	..
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan.., '98.	74	75
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	112	115
*International Ocean Tel Co.guar6%	100	3,000,000	......	1½ % Q.	107	110
Mexican Telephone Co	100	2,000,000			59½	.75
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	1½ % Q., Jan., '98.	149	150½
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000		2 % S.	78	77
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	95¼	95¾
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Aug 22:						
American Dist. Teleg. (Phila.)	25	400,000		1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	169½	174
Chesapeake & Potomac Telep. Co	100	......	......	......	48	..
Chicago Telephone Co	100	......		......	202	..
Central Dist Prtg & Telg.Co.(Pgh.)	100	750,000	750,000		..	..
Empire & Bay States Telegraph Co.	...	......			70	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	76	77
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	110	115
Providence (R. I.) Teleph. Co	50			....	85	86½
Southern New Eng. Teleph. Co	100	3,000,000		....	119	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 22:						
Fort Wayne Electric Co	..	......		....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	....	....	..	..
General Electric Co.............com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	41	41½
General Electric Co.............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	97	99
T.-H. Elec. Co..T. Secur., Series D.	..	......		....	2½	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	31	32
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., July, '98.	58	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Aug 22:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,938,000	....	132½	134¼
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '97.	122½	123½
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co					21	23
General Electric Co...........com.	100	40,000,000	30,460,000	2 % Q., Aug , 1898.	41	41½
General Electric Co...........pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	97	99
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co...pfd	..	......	......	....	..	..
Pittsburg, Pa.—Aug 22:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	180	140
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Aug 22:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	84½	85
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	41¼	41¾
*Penna. Ht., Lt. & Pow. Co......com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co......pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$32500 dis. Jan.11'97	18½	14
Southern Elec. Light & Power Co.	10	187,500	187,500	....	8	10
Miscellaneous.—Aug 22:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	....	40	..
Missouri-Edison (St. Louis)....com.	..	......	......	....	15	18
Eddy Electric Mfg. Co.	25	......	......	....	...	18
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	115	125
Hartford (Conn.) Lt. & Power Co	25	175,000	......	....	4	7
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	160	170
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	81	87
Rhode Island Elec. Protec. Co	100				110	120
Royal Elec. Co. (Montreal)	..	1,000,000	......	2½ Q	*158	158½
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	136	137
Thomson-Houston Welding Co	100			3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	.....	......	....	100	110

*ex d.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Aug 22:						
American Electric Heating Co	50	10,000,000			.05	.07
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	85	87
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—Aug 22:						
Consolidated Electric Storage Co	..	......	....	....	18	20
Edison European	..	......	....	....	1	3
Safety Car Heating & Lighting Co	100	......	....	....	..	98½
Worthington Pump Co........com.	100	5,500,000	5,500,000	....	30	33
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	90	92
Philadelphia, Pa.—Aug 22:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1	1½
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co......com	100	3,500,000	......	....	18	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	70	70½
Welsbach Light Co	5	525,100	......	....	50	50½
Welsbach Light Co., Canada.	5	500,000	......	....	1½	1¾
Pittsburg, Pa.—Aug 22:						
Carborundum Mfg. Co	100	200,000	200,000		..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	109	110
Miscellaneous.—Aug 22:						
*Barney & Smith Car Co........com.	100	.....	1,000,000	....	..	15
*Barney & Smith Car Co........pfd.	100	.....	2,500,000	2 %	..	65
Billings & Spencer Co	25				30	37
Consol. Car Heating Co	100	1,250,000	1,250,000	1¼ % Feb. '98.	30	35
Johns-Pratt Co	100	.....	....	....	..	97
*Pratt & Whitney Co..........com.	100	.....	....	....	..	10
*Pratt & Whitney Co...........pfd	100	.....	....	....	45	52
Stillwell-Bierce Co.............com.	100	.....	....	....	96	98
Stillwell-Bierce Co.............pfd.	100	.....	....	2 % Sept. 1, '97.	107	109
Shults Belting Co	100	500,000	....	....	80	82
St. Charles Car Co	..	....	....	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Aug 22, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*118½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co....................1st 5s	....	....	......	......	*105	105½

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Aug 22, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113½	114
Baltimore Traction Co........1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	113½	114
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103⅛	104
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116⅛
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	102¼	102¾
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	116	117
City & Suburban Ry......1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	114	......
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	....
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	118	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	105
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M.& N.	104	105
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry...........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry..............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¼	102¼
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	103⅛	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	54	54¾
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	104	104¼
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	104½	....
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	99¼	99⅞
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	94
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Aug 22, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	102	102½
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	108
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108½
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co.......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	102	102½
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
aEast Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102	105
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	...
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1913	M. & S.	105	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR...Deben. g. 6	100,000	94,000	1909	M. & S.	102	......

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	101	....
Crescent City RR.............1st mtg. 6s.	....	50,000	1899	M. & N.	100¼	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	76	79
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	105	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100¼	101¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	110	....
Orleans Railroad Co........Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	101⅛	....
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	104¼	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	105	110½
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	107	110
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	110	112
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	104	105¼
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	114½
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	113	114
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	105	....
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	104¼	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	101	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	111½
Central Crosstown RR.........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118⅛	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115¾	116½
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	*102
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	...
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	118	116
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	95
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	121	122
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	114	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	107	109
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.)........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115⅝
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	113⅛	114
Third Avenue RR.............1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	123	125
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	108
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	112½	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	109	......

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—Aug 22, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry...........1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry......................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry...........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry..................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943		102	103
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J. & J.	......	
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry..............1st mtg. 5s	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...............Col. tr. 4s	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry..........1st mtg. 7s	....	....	1905		....	....
West Phila. Pass. Ry.........1st mtg. g. 5s	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	90	......
Central Traction Co.............1st mtg. 5s.	375,000	375,000	1930	J. & J	......	......
Citizens' Traction Co.............1st mtg 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co...........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108⅝	......
*Fed'l St. & Pleas. Val. Jack's Run......5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	......
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	105¾	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	......
Pittsburg Traction Co...........1st mtg 5s.	750,000	750,000	1927	A. & O.	......	......
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	....	105
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co...................5s.	2,500,000	2,000,000	1934	J. & D.	....	......
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	......

Providence R. I.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	....
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation—Aug 22, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR.........1st mtg. 5s.	250,000	250,000	1918	J. & J.	100⅝	101½
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	101⅝	102½
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 5s	1,000,000	1,000,000	1913	J. & J.	111	112½

*With interest. *Unlisted.

*With interest

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Aug 22. 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	$50,000	$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co.......................1st mtg. 5s	1,500,000	1,500.000	1911	F. & A.	106⅝	107½
Missouri RR. Co.........................	1,000,000	700,000	1916	M. & S.	106	107
‡Mound City RR. Co..............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	108
People's RR. Co......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co......................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry...............Income 5s.	800,000	800,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110½	111½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co........Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	113	114
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation— Aug, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114¾	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	113½	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	92½	97½
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	126	....
†Metropolitan Ry. Co..................1st mtg.	200,000	....	......	....	....	.....
†Omnibus Cable Co..............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	124½	.....
†Park & Cliff House RR........1st mtg. 6s.	350,000	850,000	1912	J. & J.	109	.....
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	88½	110
†Powell St. Ry.........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118½	120
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109¾	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Aug 22, 1898.						
Belt Ry. Co.........................Cons mtg 5s.	500,000	450,000	1920	J. & J.	33	....
Columbia Ry............................" mtg. 6s.	500,000	500,000	1914	A. & O.	11-	122
Eckington & Soldiers' Home. mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	118	119½
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Aug 22. 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1928	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	111	112½
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	8,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	108½	110
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	101	102
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	107	107¼
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	101½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	79
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,981,000	1930	J. & J.	118	114½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	90	93
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	8,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	96	....
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	10	92
St. Paul City Ry......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Aug 22, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	107	....
Pittsburg, Pa.						
Date of Quotation—Aug 22, 1898						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Aug 22, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,812,000	1910	......	110	. ..
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117½	......
Edison Elec. Illg. Co. (Brooklyn)........	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	..	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Aug 22. 1898						
American Bell Telephone.....................7s.			1898	F. & A.	101½	....
Northwestern Telegraph Co................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Aug 22, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co....................	....	....	......	......	......	25
Barney & Smith Car Co........................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co.........................6s.	....	....	1904	M. & S.	.	....
Worthington Pump Co..........................	75,000	......	......	......	[illegible]	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 11⅞c.; Lake, 12c.; casting, 11⅝@11¾c.

The directors of the Troy (N. Y.) City Railway on the 18th inst. declared a dividend of 1 per cent., payable September 1.

The Street Railway & Illuminating Properties, Boston, has declared a dividend of $2 per common share, payable August 19 to stockholders of record August 16.

The Commercial Cable Company gives notice that the cable between Hong Kong and Manila has been repaired, restoring telegraphic communication with Manila.

The Niagara Falls Electric Railway Company has declared a quarterly dividend of 1 per cent., payable September 15. Transfer books close September 1 and reopen September 16.

The coupons of the first mortgage convertible gold bonds of the Edison Electric Illuminating Company of New York, due September 1, 1898, will be paid by the Guaranty Trust Company, New York, on and after that date.

The American Loan & Trust Company of Boston, as mortgage trustee, has applied to the United States Court at Fort Worth, Tex., for the appointment of a receiver for the Dallas Electric Company, interest on the bonds being in default. The property is said to be valued at $388,000.

War, instead of depressing stocks appears to have had the opposite effect in this country. Since war was inevitable between Spain and the United States up to the close of business last week the average price of twenty of the more active stocks had risen from 55.89 to 69.61—13.72 points.

The Metropolitan Street Railway Company of New York has declared a dividend of $1.25 per share upon the present capital stock of $30,000,000, payable October 15 to stock of record August 31. Transfer books close for cash dividend and for allotment of new capital stock on August 31 and reopen September 12.

The Edison Electric Illuminating Company of New York reports for July: Gross earnings, $196,400, increase $33,947; operating expenses and taxes, $112,348, increase $20,920; net earnings, $84,052, increase $13,017; depreciation charge, $17,500, increase $5,500; balance, $66,552, increase $7,517; accrued interest on bonds, $27,075; surplus for dividends, $39,477, increase $7,517.

The New Telephone Company of Indianapolis has made a mortgage to the Central Trust Company, as trustee, to secure $800,000 gold bonds in two series, the first consisting of $300,000 6 per cent. bonds, due in three years; the second series of $500,000 5 per cent. bonds, due in twenty years. The second series, it is stated, is to remain in the hands of the trustee until the first series matures, at which time $300,000 of the bonds is to be applied to the payment of the first series, and the remaining $200,000 to be used for extensions and betterments "then and thereafter necessary."

Justice Cohen of the New York Supreme Court has appointed James G. Graham of Newburg temporary receiver for the New Paltz & Wallkill Valley Railroad Company on the application of the directors for the voluntary dissolution of the corporation. The bond of the receiver was fixed at $50,000, and the order to show cause was set down for December 1 next. The total liabilities are $185,730, of which $150,000 are bonds; $35,530 to general creditors for materials and loans, and $200 due employes. The nominal assets are $154,196, the principal items being real estate, car equipment and power house machinery, $115,000; passenger cars, $13,000; other cars, $7,800; dynamos, $6,500; engines, $3,700.

The Philadelphia "Times" financial editor says: "There are few people today who would be willing to say the future of the United States has ever been brighter, more promising than it is at present. It is not necessary to point out why this is the case. One has only to read the daily papers to understand. Behind it all, however, is our success in this war with Spain. It is the basis upon which this country is to enter upon an era of prosperity such as we have never known. And Wall Street is now discounting as much of the business activity as it can see in sight, just as it did the approach of the war and its progress after hostilities had begun."

The Boston "Beacon" says: "Somewhat akin to the investment standing of our home railroads are the stocks of the two electric light companies which supply Boston and the citizens thereof with electric light, for these stocks, like those of the railroads, are non taxable to residents of this State. Of these two stocks, that of the Boston Electric Light Company has been unusually active during the past two weeks at constantly advancing prices. The rise has been aided by the annual report which shows that during the past year 6 per cent. dividends were paid, but that earnings amounted to some 14 per cent., from which $50,000, or say 3 per cent., were charged off for depreciation on plant accounts. The company thus earned 10 per cent. net for the year, with something to spare."

On his return from New York to Chicago last week, Charles T. Yerkes said there was "absolutely no truth in the stories of the consolidation of the North and West Chicago and the Chicago City street railway companies." Mr. Leiter makes a positive denial that his visit to the East had anything to do with street-car business. He said to a Chicago reporter: "The whole report is bosh. It is true that I went East, but I know nothing about a proposed consolidation of street-car interests. It was not for the purpose of discussing such a proposition that I went to New York, and nothing is further from my mind at this time. It can be said in positive terms that I am not connected with a deal to consolidate the North, West and South Side companies."

The Union Traction Company of Anderson, Ind., has become the owner by purchase and consolidation of the street railway plant in Anderson formerly owned and operated by the Anderson Electric Street Railway Company. This consolidation was completed July 1, 1898. The company has outstanding $300,000 of stock, all common, and has issued $600,000 of 5 per cent. bonds, dated July 1, 1898, to run 20 years, interest payable quarterly, both principal and interest payable in gold; $150,000 of these are left in trust with the Farmers' Loan & Trust Company of New York, trustees, with which to take up $150,000 of bonds outstanding, heretofore issued by the Anderson Electric Street Railway Company on the city plant at Anderson. The officers of the new company are: President, Philip Matter; vice-president, J. A. Van Osdol; secretary, Ellis C. Carpenter; treasurer, John L. Forkner; manager, Charles L. Henry.

The Brooklyn "Eagle" of Sunday has an article in which it expresses surprise at the recent advance in Rapid Transit shares and sees in the present outlook no good speculative reason for eagerness to purchase them at the latest quotations. The "Eagle" says: "The outlook for continued and largely increased earnings for the transit systems is also affected by the coming electrifying of both elevated roads. The Brooklyn Elevated Company is to electrify two of its lines and some twelve miles of its roadway this fall, and will be offering a sharp bid for increased business early next year. The entire system will be electrified shortly afterward, and the Kings County Railroad management has also pledged itself to the plan to use that method of propulsion in the near future and is now engaged in preparing to introduce it on a portion of its road in connection with bridge crossing. With the elevated companies offering quick and more frequent service, as they will be enabled to by this new system, there is no question that the street railroads will suffer and that their earnings will be affected."

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EDITORIAL NOTES.

The American Association for the Advancement of Science.

The Convention of the American Association for the Advancement of Science, which has just drawn to a close in Boston, and a brief report of the proceedings of which will be found elsewhere in this issue, was probably one of the greatest assemblages of scientists that have ever met in America. Almost every branch of science was ably represented by one or more delegates, not only from this country but from almost all the leading nations of the world. A number of prominent electricians and physicists were present, and presented papers of more than ordinary importance to the electrical profession. Almost all the topics touched upon, about 440 in all, were very timely and of exceptional interest. Several discoveries of great value have been brought to light, as many scientists had been waiting for such an opportunity to exploit their researches where they would be fully understood and appreciated. In the majority of cases these discoveries have been the result of years of profound investigation and patient toil. Dr. Brush's discovery of a new gas, which will probably form the base of a new group of elements, is unquestionably a triumph. Altogether, this Association should be congratulated for the excellent work it has accomplished at its jubilee meeting.

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The Annual Convention of the American Street Railway Association.

The Seventeenth Annual Meeting of the American Street Railway Association, which will be held in Boston on September 6, 7, 8 and 9, promises to be one of the most successful gatherings in the history of this Association. Great interest appears to be taken in the Convention by all the leading street railway men in and around Boston, which fact alone should ensure an excellent attendance. The headquarters of the Association will be at the Hotel Brunswick, where it is understood a number of leading manufacturers propose to exhibit various street railway appliances. The Convention will be called to order by the President of the Association, Mr. Albion E. Lang, at 10 A. M. on Tuesday, September 6, at which meeting several interesting papers will be read, among others one on the "Municipal Ownership of Street Railways," which should prove of interest. On the following day the Convention will meet at 9:30 A. M. At each session two or three papers will be read, which, judging from their titles and the names of the authors, should be valuable additions to the existing literature bearing on subjects of interest to street-railway men. The afternoons will mostly be given up to excursions to points of interest in Boston and neighboring towns, and on Wednesday the members and their guests will partake of a clambake at Nantasket Beach. The annual dinner, which has invariably proven one of the most enjoyable social features of former Conventions, will be given at the Hotel Brunswick at 7 P.M. on Thursday.

As a large number of ladies are expected to be present, special arrangements have been made looking to their comfort and enjoyment while the technical papers are being read and discussed. The programme for the women includes a trip to Bunker Hill monument and various other points of historic interest as well as a drive through the Park, while on Friday morning a shopping trip is planned which will include a visit to the principal stores of the Hub. Altogether the coming Convention promises to be most instructive and enjoyable.

* * *

Another Alleged Invention for Seeing by Electricity.

If we are to believe all that we hear, there should be some wonderfully novel sights to be seen at the Paris Exposition of 1900 in the section devoted to electricity. There is Szczepanik with his telectroscope for seeing by electricity, for which it is claimed he has been paid an enormous sum of money and of which so little is really known. Now a rumor is spreading that Szczepanik's telectroscope is to have a formidable rival at this Exposition in an instrument invented by a Frenchman by the name of Dussaud. This new marvel, which, according to its inventor, embodies all the advantages of Szczepanik's apparatus, may furthermore be attached to an ordinary telephone circuit, and thus is said to enable one to hear as well as see. As in the case of the Polish school teacher's telectroscope, no one appears to know exactly how the Dussaud apparatus works or upon what principle it is based. It is described in a recent edition of the New York *Herald* as follows:

"The instrument consists of a camera, at the opposite end to the lens being a revolving screen worked by clockwork and pierced with small openings arranged in spiral form. Behind this is a system of selenium layers connected with a battery whose current traverses them, and also the primary circuit of the induction coil. By means of this machine an observer at the receiving station sees on the screen the exact image produced in the camera of the transmitter."

The above explanation is altogether too vague to give one any idea of how the alleged apparatus works. It would appear however to be designed on very much the same principles that have been tried over and over again without success by inventors

both in this country and abroad. It might therefore be well to warn those who visit the great Paris Exposition not to expect too much from either Szczepanik's or Dussaud's instruments. It will be a case of "seeing is believing."

* * *

Promoting Our Export Trade With South America.

Among the measures that will come up for consideration at the next session of Congress is one that is of great importance to exporters in general and to exporters of electrical machinery in particular. The measure in question is the proposition to incorporate an International American Bank for the purpose of promoting export trade. A bill with this object in view was introduced at the last session of Congress and passed the Senate, but failed to pass the House, being crowded out by several other important measures. It has however been made a special order for the next session, when it will be brought up and undoubtedly speedily enacted into a law.

The bill is in accordance with the recommendation of the Pan-American Congress, and is designed to furnish such banking and exchange facilities as will promote trade between the United States and the countries of Central and South America. The bill provides that the bank shall have a capital stock of $5,000,000 with the privilege of increasing it to $25,000,000. The institution, in accordance with the terms of the bill, shall be under the supervision of the Comptroller of the Currency, and in the charter of corporation which the bill grants certain privileges are accorded the incorporators in view of the advantages which are expected to accrue to those interested in trade with the countries referred to above.

The people of the United States in common with those of the Central and South American republics naturally feel the importance of increasing commercial intercourse between the different portions of the American Continent, and believe the development of such intercourse has heretofore been retarded by lack of adequate facilities for exchange between the several countries, and their hope for a revival in trade is based upon the establishment of improved banking facilities which will emancipate these growing countries from their long servitude to the bankers of London and Continental Europe. No one has expressed the situation more aptly or forcibly than Mr. Theodore C. Search, president of the National Association of Manufacturers, after a tour through South America, when he said :

"As in our ocean commerce, so also in our financial relations with other countries we are dependent largely upon the services rendered by foreign interests. Particularly in our dealings with the nations to the south of us we are in urgent need of direct international banking facilities. We do $150,000,000 worth of business with South America in a year, and yet all our balances have to be settled through English or European banking houses. In the great trade centers of South America the English, the Germans, the French and the Italians have their banks, but I think I am right in saying that there is not an American bank in all South America. Manifestly this is a serious hindrance to our trade."

It is unquestionably true that the financial part of all our business with South America is carried on through Europe. Foreign vessels carry the goods, Europe receives the commissions and freights, and furthermore sells most of the goods consumed in South American countries, while the United States is the largest purchaser. This condition of things is undoubtedly due to five facts : First, we have no banks in South America; Europe has them everywhere. Second, we run few steamships to South America; Europe runs them to all its ports. Third, we have no United States stores in South America; Europe has her stores in all parts of that continent. Fourth, we sell for cash; Europe gives credit. Fifth, Europe makes goods and packs them to suit the South American trade; we do not.

Without underestimating the importance of the other facts named, it is quite obvious that the first one is at this time pressing with great urgency upon the attention of American manufacturers in connection with the desire to increase our commerce with our southern neighbors.

Under the Searchlight.

Notes and Comments on Various Topics.

IT is stated that the quarter of a million dollars spent by the Montana Power Company in the construction of the Big Hole dam has been lost to the promoters of the enterprise, as the whole structure, damaged by a flood, will have to be rebuilt from the foundation up. We believe this is one of our old friend Byllesby's enterprises, and if we mistake not, at the time of its conception we remarked that Big Hole was a very suitable name for a project in which Byllesby was a leading spirit, as the investors in it would discover. This is another of our predictions that have been fulfilled to the letter, and still we lay no claim to the gift of prophecy.

* * *

A Novel Bee Hive.

A lineman belonging to the telephone company of Flushing recently climbed one of the 60-foot poles belonging to the company with a view to adjusting some of the wires in the box at the top of the pole. To his surprise he found that a swarm of honey bees had made the box their home. By the aid of a torch made up of rags he managed to finally smoke them out, when he was rewarded by finding several pounds of excellent honey.

* * *

REFERRING to the recent reduction in capital stock of the General Electric Company, the Boston *News Bureau* of August 24 says :

There have been deposited with the American Loan & Trust Company to date 9,200 shares of the preferred stock of the General Electric Company in opposition to the directors' capital reduction plan.

The indications are that there will be no compromise of differences existing between the directors and the preferred stockholders' committee, and that the matter must await the court's disposition.

The next step in the proceedings will be the filing of the answer to the bill brought by counsel for the committee, after which the court will set a date for a hearing—probably in November.

At the adjourned meeting of the General Electric Company, it is understood that of the 15,000 shares of preferred voting in favor of the proposed capital reduction, approximately 10,000 shares were represented by the Ames estate.

* * *

THE longest span of telegraph wire in the world is said to be in India across the river Kistna. It is over 6,000 feet in length.

* * *

THE *Engineer and Iron Trades Advertiser* of Glasgow gives the following useful hints as to the handling of electrical machinery and conductors :

Never touch an electric wire that has fallen down across your way while standing on the ground, as your body will become a conductor for the electric fluid to the earth unless you have rubber boots on. Linemen are sometimes seen pulling wires about, but they have insulating boots on their feet or rubber gloves on their hands. Some people, supposing these coverings to be only used for the protection against wet weather, have foolishly grasped wires and received severe shocks in consequence. Electric wires should be handled one at a time. If it is necessary to take hold of two wires at the same time, don't do it. In handling or drawing any wire lying over any of the ordinary street wires, especially such as convey currents for electric lighting, use a dry hand line for the purpose or grasp the wire with insulated pincers. An ordinary wire clothes line may become the conductor of a deadly current. In a dynamo room touch not, taste not, handle not. The most inoffensive looking dish-pan may strike you like a mailed hand. Nothing is safe to you here unless you know everything. Let working men remember that when a company has strung wires on the crossbars of poles so closely together that a man cannot move easily between them, it is better for him to come down and resign. What profiteth a man if he has a situation if his wife be a widow? Never close a circuit without giving notice to all concerned. A telegraph notice received in the back of the neck generally arrives too late to do any good. On no condition let two wires touch your body at the same time. Don't think that any wire is not dangerous. There is a difference between a gun with a cap on it and one without that can be detected with the naked eye, but a loaded wire —who knoweth it? Trimmers employed to attend to lights in public crowded thoroughfares should be sure that the current is turned off before they touch the lamp, as the stepladders are often very high and the public object to being hit on the head by a gyrating galvanized lamp trimmer.

* * *

IT is refreshing even to write of snow just now, so it is interesting to note that in Switzerland even after an ordinary snowfall, or during frost, the snow or ice deposited on the telephone wire equals fifteen times the size of the wire. At Zurich it reached as much as thirty times that of the wire, and the weight on a span of 100 meters would thus have a snow weight of 132 pounds. A post supporting 250 wires would therefore require to support a weight of 15 tons.

* * *

AN Eastport man, it is stated, contemplates purchasing the plant of the Electrolytic Marine Salts Company at North Lubec and turning it into a sardine factory. No one will enjoy the humor of this evolution of his gudgeon factory more heartily than Jernegan himself.

A LESSON IN WATERED STOCK.

(From the Buffalo Enquirer.)

A paragraph in the news columns says the General Electric Company has scaled down its stock 40 per cent., which means that every person who formerly held one hundred shares now has sixty.

About eight years ago the Thomson-Houston Company and the Edison Company consolidated and capitalized at fifty millions. It was given out widely that stock in the new trust would pay 6 or 7 per cent., inasmuch as the two companies controlled practically the entire electrical business of America. If you looked into the matter you found out that the money actually represented by the combined plants was less than ten millions. There were over forty millions of water in the stock. But you were shown that the business of the two companies practically warranted it, as they had been earning over 10 per cent. and of course would earn more after the consolidation.

So the lambs came in and bought and the kind-hearted managers of the consolidation generously sold. Widows bought for investment. Foolish trustees put their trust funds in it. Speculators went into it expecting it to rise. They were all let in on the ground floor soon after the consolidation when the stock sold in the neighborhood of one hundred.

But, of course, even a great combination like the General Electric Company was no more able to suspend the laws of trade than you are to stop Niagara Falls. It is fixed unalterably that a business with good management can earn a normal dividend upon the money invested in it, no more—that is, for any considerable time. This must be so, because when you see one man enjoying a good thing you go in for it, too. Then somebody else does likewise, and directly the first man's capital can only make a normal earning, because he has to sell at the same prices you sell at.

When the General Electric Company came face to face with competition it could not earn a cent on the many millions of water which it was carrying, and the stock tumbled down to about thirty. It has been there ever since, and it is going to stay there, as is admitted by the action of the directors in scaling down the capitalization 40 per cent.

Nearly twenty millions of water have been wiped

out, and the people who paid $100 a share for it now have stock purporting to be worth sixty dollars which is really worth about thirty.

The question is, where did that thirty millions of hard cash go? The kind-hearted manipulators alone can answer. The lambs, the widows and the foolish speculators who were let in on the ground floor are still there, fleeced of two-thirds of their substance. This happened because they did not understand that you cannot make the water in a manufacturing stock worth par by buying it at that price.

What happened to General Electric and Cordage is likely to happen to Glucose and is not unlikely to overtake Buffalo City Gas. Financial water, like that in Lake Erie, seeks its level, and that level is zero.

MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

In Boston on the afternoon of August 22 the nine different sections of the American Association for the Advancement of Science met, and were addressed by their respective vice-presidents.

The papers read were upon subjects connected with the work of each particular section, and in almost every case were of special merit. In the section of Chemistry the Vice-President, Dr. Smith, professor in the University of Pennsylvania, presented a paper on "The Electric Current in Organic Chemistry." In this paper Prof. Smith traced the origin and growth of the use of the electric current in this branch of chemistry, paying special attention to some of its industrial features.

Another paper of interest to electricians was presented by Prof. Morley of Cleveland. The paper dealt with the question whether a magnet affects the velocity of light which passes through the field of its attraction. With the apparatus used it was shown that the passage of the current had no straining effect upon the optical portion of the instrument. Coils were used through which the current could be sent at will, and it was demonstrated that the change in intensity of the current had no appreciable effect either to retard or accelerate the wave length of light.

On Tuesday, August 23, the programme for the day was rather a heavy one, comprising meetings of the sections in the morning, several excursions to points about the city and receptions by the clubs in the evening.

The council met as usual at 9 o'clock, and after an hour's interval came the meetings of the various sections. At some only three or four papers were read, but at others the number ran up to thirty or more.

Three auxiliary associations had meetings on Tuesday, the American Chemical Society, the Geological Society, and the American Forestry Association.

Probably the most important announcement of the day was made by Mr. Charles F. Brush of Cleveland, who described at length a discovery made by him of a new gas, a constituent of the atmosphere, which he has provisionally termed "Etherion."

In the afternoon the excursion most largely attended was that about Boston Harbor. About five hundred persons were on the boat.

In the evening Mayor Quincy gave a complimentary dinner to the officers and guests of the Association. Several toasts were responded to by prominent men and the occasion was thoroughly enjoyed by all. Among the foreign guests present at the banquet were Prof. Charney, delegate of the French Government; Prof. Conrad Cooke and Prof. Benj. Howard of London; Prof. Galbraith and Prof. Blue of Toronto, and Mr. Paul du Chaillu, the African explorer.

Notwithstanding the oppressive heat on Thursday, the scientists began to gather at the Rogers Building very early, all having evidently enjoyed themselves on the excursion to Salem on Wednesday. The council of the Association after a long session elected Prof. Edward Orton, State Geologist of Ohio, President for the coming year. Columbus, O., was decided upon as the meeting place of the Association for the next Annual Convention.

As many as one hundred papers were presented at the various sectional meetings on Thursday, many of which were of great importance.

Prof. Guthrie read a paper before the section on Physics on a "Redetermination of the Ampere" which especially attracted a great deal of attention.

Several of the sections had their final meetings on Thursday, finishing the work allotted them.

In the afternoon Governor and Mrs. Wolcott gave a reception to the scientists and extended to them the privilege of inspecting the grounds of the palatial residence of the Governor at Milton Hill.

With Friday the work of the Association began to draw to a close. The members went to Harvard University by special invitation of the President and Fellows of the college and were royally entertained.

Only two sections held any meetings on Friday, the principal one being that of the physicists. The papers were mostly very technical, the most important one being "A Calorimetric Determination of the Energy Dissipated in Condensers," by Prof. A. N. Smith, of Wesleyan.

On Saturday most all the sections had completed their work, the last general session of the Convention being held at 10:30 A. M. Many scientists whose names are familiar the world over were upon the platform.

Reports showed that 903 delegates had registered as members of the Convention, 158 being from New York. Canada, England, France, Germany, Brazil, Mexico, Japan and Australia were each represented by one or more delegates, there being in all 443 papers read. Resolutions were passed tendering the thanks of the Association to Governor Wolcott, to Mayor Quincy, to the people of Boston and to all who had taken any part in contributing to the pleasure and comfort of the delegates.

Annual Convention of the Street Railway Association of New York.

The Sixteenth Annual Convention of the Street Railway Association of New York will be held at the Manhattan Beach Hotel, Coney Island, on September 13 and 14. It is expected that the attendance will be quite large, nearly 300, and the programme arranged will undoubtedly be satisfactory from a social as well as a business standpoint. The locality is one of the most delightful that could have been selected, and the names of the committee of arrangements are a guarantee that full consideration will be given to every detail calculated to gratify either the social or the business inclinations of our enterprising street car men. This committee is composed of President C. L. Rossiter of the Brooklyn Heights Railroad, President Albert L. Johnson of the Nassau Electric Railway, and President J. L. Heins of the Coney Island & Brooklyn Railroad Company.

The papers to be presented will be on practical subjects connected with the operation and management of street railways and with other things of special interest to street railway owners and officials. As a portion of the social programme of the Convention, the committee has arranged for a formal dinner to take place in the Manhattan Hotel on the evening of September 13. All the members will be present on this occasion and there will be the usual toast-making and speeches.

The president of the New York Street Railway Association is G. Tracy Rogers, president of the Binghamton Railroad Company, and Henry A. Robinson, attorney for the Metropolitan Street Railway Company of New York, is secretary and treasurer.

AMERICAN STREET RAILWAY ASSOCIATION CONVENTION.

Programme.

The following is the official programme of the Seventeenth Annual Meeting of the American Street Railway Association, to be held in Boston from September 6 to 9 inclusive:

TUESDAY, SEPT. 6.

10 A. M. Meeting called to order by Albion E. Lang, President.

Calling of the roll.

Address of the President.

Report of the Executive Committee.

Report of the Secretary and Treasurer.

Reading of paper on "Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use," by Richard McCulloch, Electrical Engineer Cass Avenue and Citizens' Street Railway Companies, St. Louis, Mo.

Reading of paper on "Municipal Ownership of Street Railways."

Afternoon.—Trip to Concord and Lexington.

Evening.—Reception at hall.

WEDNESDAY, SEPT. 7.

Convene at 9:30 A.M.

Reading of paper on "Maintenance and Equipment of Electric Cars for Street Railways," by M. S. Hopkins, Electrician Columbus Street Railway Company, Columbus, O.

Reading of paper on "Carrying of United States Mail Matter on Street Railways," by W. S. Dimmock, General Superintendent Omaha & Council Bluffs Railway and Bridge Company, Council Bluffs, Ia.

Appointment of Committee on Nomination of Officers and selection of next place of meeting.

Morning.—Ladies to be taken to points of local and historic interest.

Afternoon.—Excursion down the harbor.

Clambake at Nantasket Beach.

THURSDAY, SEPT. 8.

Convene at 9:30 A.M.

Reading of paper on "To What Extent Should Street Railway Companies Engage in the Amusement Business," by Walton H. Holmes, General Manager Metropolitan Street Railway Company, Kansas City, Mo.

Reading of paper on "Inspection and Testing of Motors and Car Equipments by Street Railway Companies," by Frederick D. Perkins, Electrical Engineer Toledo Traction Company, Toledo, Ohio.

Election of officers.

Morning.—Drive through the Park for the ladies.

Afternoon.—Trip to Plymouth.

Annual dinner, Hotel Brunswick, 7 P.M.

FRIDAY, SEPT. 9.

Convene at 9:30 A. M.

Reading of paper on "Cost of Electric Power for Street Railways at Switchboard, both Steam and Water," by R. W. Conant, Electrical Engineer Boston Elevated Railroad Company, Boston, Mass.

Report of Committee on Standing Rules for Government of Conductors and Motormen.

Unfinished business. Installation of officers. Adjournment.

Morning.—Shopping trip for the ladies, visiting principal stores.

Afternoon.—Trolley excursion to Norumbega Park.

Shocking Accident in the Alps.

As we go to press a cable from London announces the accidental death in Switzerland of John Hopkinson, "the celebrated English electrical engineer," and that of his son and two daughters. From the meager information at hand, we learn that the party started out on August 27 from Arolla, in the Canton of Valais, to ascend the Dent Vesivi without a guide. As they did not return at night a searching party was organized, with the result that all four bodies were found at the foot of a precipice over which they had fallen.

LONDON NOTES.

[From our London Correspondent.]

Electric Tramway Systems.

That it is anything but an easy thing to secure permission to use electricity on numerous English tramways is clearly proved by two recent instances. The Bristol Tramways & Carriage Company and the London United Tramways Company have for several years been having a hard fight, and now they are both to be congratulated upon having won that for which they fought, but only after protracted negotiation and expensive procedure. As regards Bristol the facts are: In 1895 the company equipped part of its system of horse trams with the overhead trolley, and after a few months it was found that the economy and success were so great that there should be no delay in equipping the entire Bristol service in a similar way, and also it was arranged for various extensions. The company applied for powers, but the municipal authority had its eyes open to business and after considerable discussion arranged that the company should not be allowed to carry out its wishes unless it agreed to take the necessary electric power for the purpose from the municipal electric lighting works. For obvious reasons the company refused to fall in with these suggestions. It stuck to its guns with great determination, and has at last succeeded in getting Parliamentary powers for the purposes mentioned. The officials are at the present moment drawing up their plans for the reconstruction of track and the erection and equipment of a central power station which will be situated at Counterslip. New capital for these purposes will be raised to the amount of $1,250,000.

It will probably be remembered that in 1896 English rope-driven plant was turned out of the Bristol Company's St. George's power station and American direct-coupled machinery was installed in its place. There would therefore seem some probability that American generators and apparatus will be required for the new power house. It is hoped to have the entire Bristol service operated electrically before the end of the year 1899, so that some contracts may be given out before very may months have passed.

The other company that has succeeded in securing powers to install the trolley system is the London United Tramways Company. The company will in all probability be engaged equipping twenty miles of tramway on the trolley method in some of the suburban districts of London. And judging from plants which have been put down by the moving spirits in this company for other lines in England during the past year or two, there is every indication that American machinery and apparatus may be expected to predominate.

CANADIAN NOTES.

The town of Dundas, Ont., will give a franchise for fifteen years to an electric lighting company, of which Geo. H. Harper is managing director, the town to have 150 incandescent lamps and four arc lights.

The proposed electric railway between the towns of Lanark and Perth, Ont., is being revived. The subscribed capital is now said to be sufficient to build the road, and the company undertakes to complete it by the first of April next.

The West Kootenay Power & Light Company is now delivering 1,000 horse-power in Rossland, B. C., from its generators at Bonnington Falls, 30 miles away.

A number of Montreal gentlemen have purchased a mountain at St. Bruno, in the Chambly district, about 10 miles from Montreal, and propose spending a large sum in improvements. An electric railway from Montreal to St. Bruno is included in the plan.

Another very heavy transaction in electric property is on foot in the province of Quebec. Following the absorption of the Quebec District Railway Company by the Quebec, Montmorency and Charlevoix Company, the latter is about to acquire the property of the Montmorency Power Company, which furnishes the city with electric light and the street railway cars with their motive power. It is understood that the purchase price is $1,250,000. A meeting of the Quebec, Montmorency and Charlevoix Electric Railway Company will be held on the 13th of September next to ratify the purchase. The shareholders of the power company will receive a handsome premium on their stock, which will be 25 per cent. of its value in cash, while they will also raise in the stock of the Quebec, Montmorency and Charlevoix Railway an amount equal to their stock in the Montmorency Power Company.

Mr. Henry Symons, Q. C., has recently returned from England where he had estimates prepared for the construction of the proposed works of the Welland Power & Supply Canal Company. This project involves the construction of a canal from the Welland river to the brow of the mountain at Thorold, Ont., a distance of 8 miles; the construction at Thorold of a power house, and from Thorold to Lake Ontario a raceway by which to carry water into the lake. In addition to these different works estimates were obtained for the construction of a transmission line from Thorold to Toronto by way of Burlington Beach. The estimates obtained by Mr. Symons were prepared by Dr. Hopkins, F. R. S., one of the leading electricians of Great Britain; Sir Douglas Fox, Edmund Wragge, late of Toronto, and W. C. Unwin. The estimate for the machinery to generate 100,000 horse-power is £125,000; for transmission line to Toronto at a voltage of 10,000 and delivery of 50,000 horse-power, £801,600; for excavation and other work connected with the undertaking, £1,525,062. The total estimate therefore amounts to £2,452,162, or roughly speaking, $12,000,000. If the amount to be delivered in Toronto is reduced to 20,000 horse-power the project would cost $1,000,000 less. S. Pearson & Son, contractors, state that if the contract could be secured from the cities of Toronto and Hamilton for a considerable quantity of power for a definite term there would be little difficulty in raising money for the project by bonds and shares in Great Britain.

MINE SIGNALS.*

In a paper read by Mr. Clements before the South African Society of Electrical Engineers, attention is drawn to the various systems of signaling. The old-fashioned system is, of course, the hand-pulled rope and bell, or flapper, as used so much to-day in English coal mines, the difficulty of which is that in very deep mines there is apt to be an uncertainty in its indications, and the engine man cannot always tell if each pull of the rope has produced a sound. In America a pneumatic system is used, consisting of a line of pipe and an air cylinder about 6 inches in diameter by 9 inches long, with a piston movable by a lever which is employed to give a sudden push of air down the pipe line to blow a whistle all over the system. The pipe used is recommended to be at least 2½ inches, and even more for long distances. The pipe should be smooth inside, as it can then be talked through, which is not possible with rough pipe, although signaling can be effected through rough pipe. Though by no means perfect, electrical signaling seems to be, on the whole, the best.

If there are, say, balanced skips for which to arrange signals, there are three wires run down the shaft, two being connected to the poles of a battery, and the third, or middle wire, being used to connect all bells in series and ring them simultaneously when a circuit is made through any push on the system. All bells are, of course, to be placed between the middle wire and the same pole wire, and the pushes between the middle and other pole wire. A separate signal should be arranged from the pit mouth to the engine room, and vice versa, for the driver could not otherwise tell whence the signal comes, whether from the top or the lower set of skips.

A bell at the pit mouth keeps the banksman informed as to what the skips below are doing. Communication with the signals below must only be possible via the engine driver's apparatus. The chief disadvantage of the system is, that the driver has no means of knowing the places of the skips except by the correctness of the signal given, but the author has never known of an accident, as the bells ring simultaneously through the mine when rung from any one place, and those at any level know thereby where the skip is and what it is doing.

In a second system a separate wire is run to each level, the two battery wires being run to each level also, and when a signal is sounded it rings only the bell at the one place and a bell or indicator at the mouth and in the engine room. This system simplifies the code of signals; the driver knows what he is doing, but the cost and complexity are increased. The first system is that which the author advises. The wires may be run in either iron pipes or wooden conduits of deal two-eighths in thickness, run along the roof timbers in an incline, and coated in and out with coal tar, the wires, No. 18 S. W. G., and lead covered, being held in position by wooden cleats, and all bells and pushes being placed in wooden boxes. This system worked well for eight months, after which the settling of the shaft so stretched the wires that they broke, though no further trouble has since arisen. Though exposed to much acid water, the lead-covered wires had not been affected.

When conveyed in iron pipes trouble has been found from internally condensed moisture, and from grounding of the wires in the pipes.

The Robinson Deep and the Simmer and Jack discarded a pipe system, and installed a bare copper wire system on double petticoat insulators of porcelain. But little trouble has been experienced. The wires should be at least 7/18 S. W. G., and they should be shackled off at distances of each 100 feet, and a bight made in the wire to run off moisture. Below a bight in the shaft the wire continues, not directly underneath the length above, but to one side. Armored cables should be pure rubber, insulated with a lead covering to the conductor and a steel wire sheathing. Such a cable can be bent round corners without injury to any part. In vertical shafts it may be hung well up in a corner of the ladderway, and in inclines in an upper corner of the skipway. The author considers that armored cable is the best for signaling purposes. He considers that one quadruplex cable is fully as good as a pair of duplex cables, i. e., one for the pole wires, and one for the two middle wires. Steel-sheathed cable may carry its own weight in vertical lengths of 300 to 400 feet, the connections between the lengths being in watertight boxes.

At pump stations or landing stages, cable should be boxed in for 10 or 12 feet above landings, and no inclines cable ought to be removed from the risk of having hung on it lamps, tools, etc., and general precautions taken against injury.

There is no satisfactory signal bell known to the author. Pushers, in general do not give satisfaction. The galvanometer key is better. Pulls, likewise, are apt to be unsatisfactory, as they depend on springs, which are apt to fail by rust. For batteries the secondary cell is preferable for cleanliness and compactness. The Leclanché primary is satisfactory if properly attended. Whatever form be employed, there should always be an auxiliary. The EMF. should range from 6 to 16 volts.

Bells and pulls must be inspected weekly at least, and all contacts kept bright.

* From the *Electrical Review*, London.

NOTES ON THE ELECTRO-CHEMICAL TREATMENT OF ORES CONTAINING THE PRECIOUS METALS.*

BY MAJ.-GEN. C. E. WEBBER.

(*Concluded from page 103.*)

In the latter half of 1894 J. H. Haycraft of Adelaide, in West Australia (whose invention jointly with Breakell has been already mentioned), described an improved process for the treatment of auriferous and argentiferous ores. He expressly disclaims originality for the apparatus, and for any separate part of his process, or for any two or more parts together, but considers that his invention consists in the entire and particular combination planned by him.

In this process we again find the following conditions: One circular vessel for the whole process of treatment, having a revolving stirrer with projecting arms connected with the positive pole of a dynamo. The charge under treatment is a mixture of pulverized ore and water, and the precipitation is obtained by the use of a solvent in conjunction with the electric current, the precious metal being absorbed (and afterwards recovered) by amalgamation in mercury. But, in addition, the process presents the following features:

First, the vessel is heated by a furnace or by a steam chamber underneath, and being therefore of metal, the whole of it forms the cathode.

The stirrer, which is the anode, can doubtless be insulated from the vessel without much difficulty, and its arms are clad with carbon electrodes at their extremities, which in revolving are separated from the cathode by a space of about a quarter of an inch.

To the charge of ore is added about 5 per cent. of its weight of mercury, with about 1 per cent. of chloride of sodium or any other salt capable of yielding chlorine by electrolysis; but these proportions the inventor varies according to the class of ore under treatment.

Very little practical experience in working an apparatus of the description given by Haycraft might be expected to fail in three out of many difficulties that the construction presents, namely: (1) in keeping the density of the solution uniform throughout; (2) in bringing it under the influence of the current within the one-fourth inch space between the anodes which lie nearest to the cathode, where the path of the greater part of the current would lie; and (3) the difficulty of maintaining surface parallelism between the electrodes.

In September, 1894, P. Danckwardt patented in the United States an improved apparatus for and process of extracting gold and silver from ores.

In this we find again the treatment of finely pulverized ore in a solution containing potassium cyanide —in this case about 10 lbs. of cyanide to the ton of ore—and agitation. Besides, the inventor adds to the solution 2 to 3 lbs. of ammonium, "or another alkali," sulphide, the object of which is said to be to reduce the consumption of cyanide to a minimum, as a means of preventing "the formation of soluble combinations between any of the raw metal combinations and part of the cyanide of potassium."

The agitation is effected by the rotation of a cylindrical drum A on its axis, and two ways of doing this are described. In one case (Fig. 7) the rotating drum is external to the inner one, and the conditions are the other way in the second example (Fig. 8). In each case the cylinder in motion, B, constitutes the anode, the stationary vessel the cathode. In the first case the outer revolving drum carries internally blades, *k*, *k*, by which the solution is stirred and guided on to the amalgamated surface of the inner fixed cylinder B, which is made of copper.

The second example (Fig. 8) of effecting agitation in this way is an auxiliary one, and only resorted to in case the extraction by means of the first form of apparatus is imperfect, when the solution taken from the first having been filtered is passed through one or more of the agitating vessels; and in this latter case the outer and stationary tanks, A, A, besides being amalgamated on their inner side, contain a little mercury, M, M.

In spite of the low tension of the current employed the difficulty of insulation between the cylinders at their axial bearings must be considerable. I can find no record of this combination having ever been used on a practical scale, and I do not think that the description given is such as to enable an apparatus

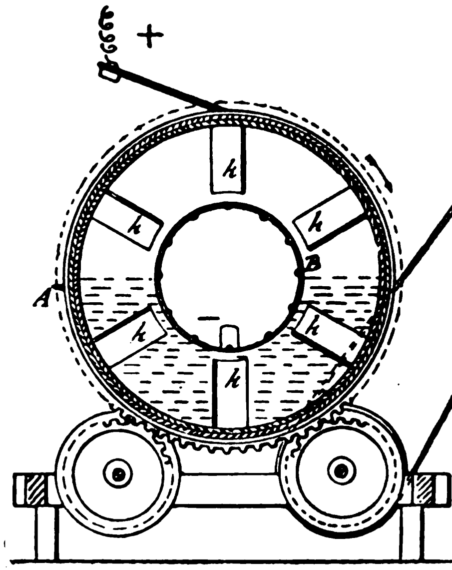


FIG. 7.

to be constructed that would produce practical results on a working scale. The actual subjection to electrolysis of the mixture described was, of course, not novel in 1894.

Edward W. Clark filed an application in the United States in November, 1894, describing a process and apparatus, which he calls an "electric chlorinator," for extracting ores by electrolysis.

He passes an electric current through a solution containing the crushed ore to be treated and chloride

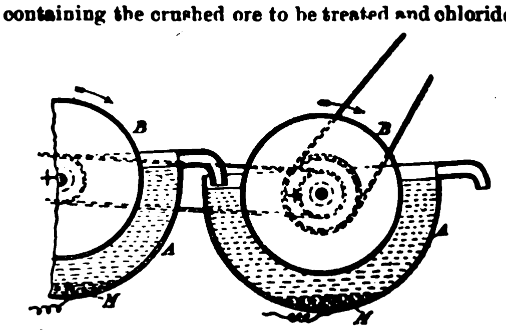


FIG. 8.

of sodium. He uses an agitator of a particular form, and mercury as his cathode.

The vessel in which the agitation takes place is a horizontally fixed cylinder, A, with a shaft B, carrying spirally fixed stirring arms, C, which revolve inside on its axis. The bearings are gas and water tight.

The anode is a fixed carbon lying on the bottom of the cylinder. The mercury cathode lies at the bottom of small boxes, D, D, attached in pairs at intervals on each side of the cylinder. The communication between the cylinder and the boxes is by means of openings, E, E, at the lower sides of the former, which are covered with a canvas screen or filter. The current has to pass between the electrodes through these screens, in company with the solution on its way for the chloride of gold to deposit the gold in the above-named boxes or amalgamating chambers.

With the exception of that part of the combination which is effected by the special form of apparatus, and which is said to prevent the combination of the liberated hydrogen, oxygen and chlorine, there is no reason for claiming novelty for the invention.

At the end of 1896 Dr. Keith, who read a paper on "The Electrolysis of Gold," in March, 1895, before this Institution, took out a patent in Canada, in which he makes, amongst others, a claim for a "process of extracting gold and silver from auriferous and argentiferous materials, rocks or ores, which consists in submitting them to the solvent action of a solution of cyanide of potassium, containing a solution either of cyanide or bromide of mercury, or both, and then depositing the gold or the silver, or both, and the mercury from the solution so obtained, by means of electricity upon a cathode or an amalgam."

I understand that this was reported on by Prof. Silvanus Thompson, but the only encouragement I can find in the published part of his report is, that the "process hastens the solution of the gold, in comparison with the use of potassium cyanide only."*

I now propose to go more carefully into the process I have described as that of Messrs. Pelatan-Clerici, which I have had under my observation for more than two years.

It claims as its object the treatment of ores containing gold or silver, or both, so as to obtain the precious metal therefrom in a manner more complete, simple, satisfactory and with greater economy of the agents, than hitherto.

As an example, I shall refer to the simplest form. The improvements are:

First, that the space (unlike some previous proposals) between the revolving anode and cathode is free from all obstructions, the disadvantages of which are that they tend to cause the ore under treatment to accumulate upon the cathode and prevent perfect parallelism between the surface of the mercury cathode and the effective under surface of the anode —a condition the necessity for which is obvious.

Second, that the sludge is constantly and gently swept by the current from over the cathode so as to have no tendency to settle on it, and also so that that portion of the sludge which is above the anode should not acquire such a continuous rotatory motion as to cause the heavier particles to be carried outwards by the centrifugal action, and thus to travel round in the same plane, instead of in their turn being subject to the combined action of the electric current and the chemical agents employed.

This leads me to draw attention to the necessity that efficient agitation should, in the first place, maintain the sludge perfectly homogeneous throughout its mass, and in the second place, should not be such as to disturb or break up the mercury cathode. In the example before us this is secured by regulating the speed at which the anode is driven, according to the size of the vat and the number and length of arms that are attached to the shaft, either for the support of the anode plates, or to act only as stirrers. For instance, subject to the density of the sludge, it is found that, if the speed of the agitator has to be lowered 30 per cent., the number of arms should be doubled.

As the diameter of a vat is increased, in order to maintain homogeneity in the mixture the rate of motion at the periphery of the agitator would have to be increased, but to the detriment of the surface of the mercury cathode, namely, above a rate of about 8 to 10 feet a second. To avoid this the number of arms is increased. Provision is also made to meet special circumstances, to add arms which vary in length, which may form part of the anode or not.

The proportion of water to ore in the sludge is a condition that also affects this department of the treatment, and it is found that between equal weights and proportions the best results are obtained when the water weighs three-fifths of the ore.

* Paper read before the Institution of Electrical Engineers, London.

* Similar means to some of those I have mentioned for doing the same work have been patented by De Neufville, September, 1895; Recker, August, 1897; but, with the exception of the combination of very minor details, these present no features of originality.

As regards the current, the potential should be capable of being governed between 5 and 14 volts, and this must be done by resistances fixed in the circuit of each vat or group of vats. For instance, when using vats of 9 feet interior diameter, each capable of treating 2½ tons of ore in two shifts—total 5 tons—in a day of 24 hours, should a plant to treat 200 tons of ore a day be worked, 40 vats will be required, and these would probably be governed in eight groups of five vats in a group. The quantity is regulated by the resistance in that part of the external circuit which lies between the electrodes. Provision is made for a minimum quantity of 1½ amperes per square foot, being half the sum of the cathode and anode together in square feet; thus, if that area is equal to 52 square feet, the current should not be less, and not much more than 39 amperes.

The inventors claim the use of several other forms of apparatus to effect the same objects, the details of which are more or less original, and are wholly original as forming parts of combinations; and they also describe conditions of variations of temperature during the progress of the treatment, as well as the addition of specific oxidizing agents and compounds and organic acids—all of which are matters appertaining to the discoveries they have made in experimentally treating samples on a working scale of ores from over 200 mines.

In an investigation of the electro-chemistry of the process I shall confine myself to the simplest (or circular) form of apparatus.

But before doing so it is well to remind any mining engineers who may be present that the degree of fineness of the pulverization employed is obviously a varying factor in considering this part of my subject, both as regards the chemical and electrical, and their combined effects, especially when dealing with refractory ores.

The advocates of treatment by simple leaching with chemical solutions dislike fine crushing, say, finer than will pass a mesh of 20 to 30 to the lineal inch, because it encourages the formation of "slimes" in the presence of which systems of treatment that act by means of percolation become less effective.

In those systems of treatment in which extreme fineness is not detrimental—rather otherwise—crushing so that the powdered ore will pass a mesh of 80 to 100 to the lineal inch is easily practicable, and makers of milling machinery have no hesitation in facing the problem.

Even then the way in which the work is done depends on the nature of the ore and the means employed. For instance, with some kinds of gangue, and of milling machinery, the particles in which the precious metal is intimately attached to a baser metal—say iron pyrites—instead of the result rendering them more pervious to chemicals, they may be found to be pressed out in solid, rounded and smooth atoms, and in the worst form for separation and subsequent stages of the process.

These conditions would govern the net results, subject to the cost of fine crushing.

To enable you to follow the course of what happens in the treatment tank, the process will be divided into more than one stage, although the actual order in which they follow one another, and the time occupied by each, may vary with the ore under treatment, and it is not always the case that it is worth while to separate them even for a short time.

During the whole time of treatment, "agitation" as distinguished from "percolation" or "circulation," is going on. The stages may be with or without the accompaniment of an electric current during portions of the time, but in any case the current is used during more or less of the time.

The liquid may contain sodium chloride (Na Cl) or potassium cyanide (KCN) alone, or both; but as the sodium chloride is directly and in the first instance used to "reduce the resistance" or "increase the conductivity" of the solution, there is no stage during which—except for the purpose of mixing—it is used alone, without being accompanied by the current.

The expressions I have used—namely, "reduction of resistance" and "increase of conductivity"—are useful because they are easily understood; but, be it remembered, they are not correct as applied to the solvent, i. e., water. Indeed, these descriptions of the effect of the mixture of sodium chloride in a solution, and then placing that solution between an anode and a cathode is scientifically inaccurate. What happens to the sodium chloride in solution in water is, that it is disintegrated and re-formed, and thus it becomes the intermediary by which, at the instant that chlorine gas and sodium are set free the current is enabled to "communicate" between the electrodes.

During the time of electrolysis, when the liquid contains only sodium chloride (Na Cl), the primary decomposition will be sodium (Na) and chlorine (Cl). In practice the quantity by weight of Na Cl may be between 0.2 and 1 per cent. of the weight of the ore in the sludge, but this depends upon the nature of the gangue. In any case, the presence and addition as required of sodium chloride is a regulator of the electrical resistance of the solution which at any given moment is situated between the cathode and the anode, and as the resistance in the conductors counts for very little, it practically affords means of governing the current in the external circuit of the electrical generator or dynamo. Of the several compounds which might be used for the same purpose, common salt is doubtless much the cheapest.

Now to consider the action of these products of electrolysis. As the sodium is liberated, in contact with the mercury cathode, a small proportion will no doubt be dissolved in the mercury as an amalgam. If the current ceases, this is converted into sodium hydrate (Na HO), with liberation of hydrogen.

But the greater part of the sodium liberated will react at once with the water in the solution, giving Na H O and H, the former to be used as described further on. Most of the chlorine liberated will at first be dissolved in the solution, but, as the liberation will take place at the surface of the anode, a small quantity may be used up in attacking the metal of which the anode is made.

While this is going on, the liquid immediately in contact with the cathode will become rich in sodium hydrate (Na H O), and the agitation will cause it to come in contact with the chlorine liberated at the anode, with some of it to re-form sodium chloride (Na Cl), and with another portion sodium hypochlorite (Na Cl O) and water (H_2).

$$2\,Na\,H\,O + Cl_2 = Na\,Cl + Na\,Cl\,O + H_2\,O.$$

At a higher temperature, say 130° Fahr., the Na Cl O would become sodium chlorate, according to the following equation:

$$3\,Na\,Cl\,O = Na\,Cl\,O_3 + 2\,Na\,Cl.$$

This formation of hypochlorite in solution will, subject to the adverse conditions caused by agitation, be directly in proportion to the quantity of Na Cl used to regulate the resistance, and with the relations of the areas of the anode and cathode respectively.

But this formation of sodium hypochlorite will be limited by the extent to which the sodium hydrate above referred to, when it is liberated at the cathode, rises to lay hold of the chlorine which is rich around the anode. This we may regard as taking place in spite of the agitation of the stirrers, which probably tends to cause temporarily a rapid diffusion of the chlorine and sodium hydrate separately in the solution, although eventually they must come together.

Although, when not in excess, it is a useful oxidizer, this formation of sodium hypochlorite has little advantage; and when potassium cyanide is added to the solution, it is, when in excess, even when alkaline, likely to oxidize some of it into potassium cyanate—a decided disadvantage, as it is a salt which is easily decomposed, and much less useful.

Let us now consider what may be effected by the chlorine liberated, but not engaged, as above described. In the first place, one might expect the nascent chlorine to attack some of the baser metallic ores present in a finely divided state. For instance, sulphides, selenides, arsenides, etc., often attached to particles of gold or silver, would be so attacked; the chlorine uniting with the metallic base iron (Fe) or copper (Cu), and the (S) sulphur (Se) selenium, or (As) arsenic being oxidized by the combined action of the chlorine and sodium hypochlorite above alluded to, into sulphuric, selenic or arsenic acids.

These changes would be marked by the formation of sodium sulphate, sodium selenate, etc., and the consequent formation of free acids, including hydrochloric acid. The reaction in this process may be represented in two stages, as follows:

$$Fe\,S + Cl_2 = Fe\,Cl_2 + S,$$

or $Fe\,S_2 + Cl_2 = Fe\,Cl_2 + S_2$ (iron pyrite), and

$$S + Na\,Cl\,O + 4\,Cl + 3\,H_2\,O = Na\,H\,S\,O_4 + 5\,H\,Cl.$$

This probably represents what actually is the cause of disintegration of some of the metallic compounds which are present in refractory ores, as the chlorine attacks these first in preference to the gold. At the same time, it is no doubt the case that, as the process continues, some of the gold is brought into solution by the chlorine diffused through it, as chloride of gold ($Au\,Cl_3$), which is readily deposited by electrolysis on the mercury.

We all know that the solution of gold by chlorine is in common use, but I think that in the example given it is effected under novel conditions, the chlorine being added electrolytically instead of mechanically.

During the first two or three hours of treatment by agitation with the electric current, there is no doubt that the free gold which is not dissolved will be precipitated, the heavy particles at a very early stage of the process.

In all such mixtures there is also more or less of what is called "float" gold, which in the processes using "percolation," and even "circulation," is lost in the "slimes." These particles, if they escape solution, will be so well mixed up in, and diffused through, the solution by agitation, that they should all in their turn be brought into close neighborhood of the mercury surface of the cathode.

The advantage of mechanically adding small quantities of sodium to mercury employed in gold extraction to assist amalgamation has long been recognized, but in this case the sodium so used is provided electrolytically. There is little doubt that the heavier particles of gold and silver which reach the bottom by subsidence will, owing to the surface being strongly polarized both by the current and by the slight amount of sodium amalgam formed by the current, be more readily amalgamated, and the same conditions also will promote the seizure by the mercury of the minute particles of float gold and silver when they approach its surface. The reason for this is probably not merely that it is thereby "kept clean"—i.e., free from oxide in the well-known sense—but that the difference of electrical potential set up between the mercury and the liquid alters the surface tension at the liquid junction, and helps the metallic particles to come in actual contact with the mercury. This is, I believe, a new way of defining what occurs when what is called "prevention of flouring," and the establishment of metallic contact with the mercury, takes place.

The presence of the excess of an acid such as hydrochloric acid has to be provided for by the addition say, of lime, to make the solution neutral; but this will not get rid of any excess of hypochlorite, previously mentioned, if present.

Lime, to remove free chlorine, will not be added until any metals in the solution, such as copper sulphides or arsenides have been formed into electrolyzed salts through conversion into chlorides. These,

which cause waste of cyanide of potassium, would to a certain extent go into solution, and by electrolytic action become deposited in the mercury and their values saved.

It will be understood, therefore, that all this preliminary work not only amalgamates a large proportion of the free gold and silver, but also prepares for the more effective action of potassium cyanide, both as a solvent and as an auxiliary in producing the condition of increased conductivity in the solution.

Thus, everything that chlorine can do to help the disintegration of the metallic ores which are found accompanying gold facilitates the action of potassium cyanide when it is added. This preliminary disintegration would be helped, not hindred, by temporary increased acidity of the liquid, when bodies like sulphides are oxidized at the expense of the chlorine; showing that the best time for neutralizing the solution is at the end of this preliminary stage, and just before the potassium cyanide is introduced.

In all this preliminary stage it will be seen that the eventual economy of potassium cyanide (or other solvent) should be aimed at, because, although with "percolation" processes the "leaching" can be effected with even half a pound of it, as much as two pounds of it to the ton of ore under treatment may be here required. Obviously, the greater part of it is wasted, as in treating a low grade ore containing, say 15 grammes of gold and say 30 grammes of silver, 60 per cent. of the gold and 40 per cent. of the silver may be separated and amalgamated in the first two or three hours, and before the potassium cyanide is added. Clearly it does not require 2 lbs. to treat 6 grammes of gold and 18 grammes of silver, even if all the values that remain in the sludge could be dissolved.

The addition of potassium cyanide (KCN) to an ordinary agitating vat causes the solution of some of the finely divided gold; and a further solution will ensue when, by the passage of an electric current, a decomposition yielding free cyanogen at the anode and caustic potash and hydrogen at the cathode will ensue. So far the reactions are common to all arrangements which combine agitation with electro-cyanide processes. They are, with dissolved oxygen alone available—

$$4\,KCN + Au_2 + H_2O + O = 2\,KAu\,(Cn)_2 + 2KHO;$$

with nascent cyanogen—

$$KCN + Au + CN = K\,Au\,(CN)_2.$$

The addition of potassium cyanide in excess in the Pelatan-Clerici process has been doubtless due to the necessity of allowing for the oxidization of it by any excess of hypochlorite previously mentioned.

$$Na\,Cl\,O + KCN = Na\,Cl + KCNO.$$

It is also desirable to have some cyanide to spare, because the cyanogen ($C_2\,N_2$) formed at the anode and dissolved in the solution will readily unite with the minutest and lightest particles of gold, to form with some of the said excess of it the double cyanide of gold [$Au\,K\,(CN)_2$], which is a salt that is easily soluble and readily electrolyzed.

These conditions point to the advantage of getting rid of any excess of hypochlorite and of acidity by neutralization before the cyanide (KCN) is added; also avoiding excessive oxidization of it, when if an insufficiency were to ensue and tests were neglected it is possible that Au CN might be formed and remain insoluble, and hence escape electrolysis and pass away in the tailings.

There is an advantage also in the simultaneous electrolysis of both sodium chloride and potassium cyanide, though the duty of the former is principally to facilitate the conductivity of the electrolyte. Chlorine and cyanogen are both yielded at the anode and would probably lead to the production of cyanogen chloride, which (in common with cyanogen bromide) would be in the presence of potassium cyanide as effective in attacking gold, if not more so, as cyanogen itself. The difference between this and what is known as the Sulman-Teed process is, that in it cyanogen chloride (or bromide) is added mechanically to a solution containing potassium cyanide and gold or silver ore, whereas in this process the conditions to effect a corresponding reaction are produced electrolytically.

To Mr. E. F. Herroun of King's College I owe every thanks for assisting me to prepare the above investigation of some of the features of the process.

POWER NECESSARY TO KEEP TRAMWAY CARS IN MOTION.*

This subject is of course a very simple one, but it has been suggested to us that it might be a convenience to readers to give in a compact form for purposes of reference the method by which the horse-power is arrived at. We shall take the two separate cases of a car on the level and a car climbing a grade. In each case the horse-power means the product of the speed and the actual pull on the car as with horse or cable traction, or its equivalent in rotating power applied to the axle as in the case of a steam or electric car. It is the actual useful power which must remain after all losses in generation, transmission and transformation are deducted. A rule for calculation can probably be better remembered and more easily applied if, in addition to giving the rule in words, it can also be reduced to a simple formula which can be applied to the solution of every case. The foundation of the rule is the tractive effort per ton needed to keep a car moving at uniform speed on a level straight track. Experiment shows that on the average this pull is equal to about 30 lb. per ton. If the rails are exceptionally clean, say when heavy rain is falling and the grooves are completely void of dirt, the pull may fall to considerably under 20 lb. per ton, approximating to the 10 lb. or 12 lb. per ton necessary on a level steam railway. On the other hand, with very dirty clogged rails the pull may have to be more than 30 lb. Taking it at the average, the whole force resisting motion is 30 lb., multiplied by the weight of the car and passengers in tons. The speed of the car in miles per hour must be worked out in feet per minute, and manifestly the product of the total pull in pounds multiplied by the number of feet traveled per minute will give the number of foot-pounds per minute expended. Divide this by 33,000 (the number of foot pounds per minute equal to one mechanical horse-power), and we have the horse-power exerted. Accordingly to focus the rule we may write:

$$\text{HP.} = \frac{T \times W \times S}{33{,}000},$$

where T represents tractive force per ton, W the weight of the car and passengers in tons, and S the speed in feet per minute. To apply the equation to a given case it is required to find the power necessary to drive an electric car, weighing with passengers eight tons, along the level at a speed of eight miles an hour, the tractive resistance being 30 lbs. per ton. The speed in feet per minute is here:

$$\frac{5{,}280 \times 8}{60} = 704.$$

We accordingly have:

$$\text{HP.} = \frac{30 \times 8 \times 704}{33{,}000} = \frac{168{,}960 \text{ ft. pounds}}{33{,}000} =$$

5 horse-power fully.

To calculate the total power consumed when the car is mounting a grade we obtain the power as before for traveling on the level, then the power necessary to do the work against gravity, and add the two results together. When the steepness of the incline is given, we get the vertical rise of the car per minute by dividing the number of feet traveled per minute by the number of feet in which a vertical rise of one foot occurs—say 30 feet when the grade is 1 in 30, 20 feet when it is 1 in 20, and so on. Then the weight of the car and passengers in pounds multiplied by the number of feet of vertical rise per minute gives the number of foot-pounds per minute against gravity. If S is the speed of the car in feet per minute, F the distance in feet in which a vertical rise of 1 foot occurs, and W′ is the weight in pounds of the car and passengers, then

$$\text{Work in ft. pounds done against gravity} = \frac{S}{F} \times W'.$$

We can now apply both elements to a case. If a car weighing with passengers 8 tons is traveling up an incline of 1 in 16 at 6 miles an hour, the tractive resistance on the level being 30 lbs. per ton, what horse-power is being consumed? First, get the power for the level. The equation for this is:

$$\text{HP.} = \frac{T \times W \times S}{33{,}000}$$

$$\text{HP.} = \frac{30 \times 8 \times 528}{33{,}000} = \frac{126{,}720}{33{,}000}$$

To save an extra division we may here leave the 126,720 foot-pounds as it stands. Now for the work done against gravity, represented by

$$\frac{S}{F} \times W'.$$

This is equal to

$$\frac{528}{16} \times 8 \times 2{,}240 = 33 \times 17{,}920 = 581{,}360 \text{ ft.-lbs.}$$

It will be seen from the above that the vertical rise per minute is 33 feet, and the weight of the car is 17,920 lbs. We now add the work done on the level to that done against gravity and divide by 33,000:

$$\frac{126{,}720 + 581{,}360}{33{,}000} = \frac{708{,}080}{33{,}000} = 21\tfrac{1}{2} \text{ HP. (nearly).}$$

It seems really absurd to use something like an algebraic equation for such a simple matter when one is working out a case with a rule before him, but it is put in that way here as an aid to memory. Most people will agree that if an equation is few in its terms it sticks in the mind when the signification attached to each letter is known.

The above results have no application to the question of the power necessary to start a car from a position of rest. The exact power can hardly be stated for any particular case, as it is variable, depending a great deal on the slightest of grades at th point covered by the wheels at the moment of starting, and on the presence even of small obstructions on the rails immediately in front of the point of contact of wheel and rail. It is not far wrong, in the case of a start on level, or approximately level, track to take the power necessary at three or four times that required for maintaining uniform speed. This great power however is only needed for a moment, and rapidly falls off as speed is gained.

The rule for ascertaining the power used in climbing inclines applies (when calculating the total power expended at the cars on a tramway) equally to all forms of haulage except cable traction. In the latter case all the cars on the line are attached to the cable, and the number descending a hill at any given time may be taken on the average to equal the number ascending. Hence the gravity of the descending cars helps the ascending ones, and so saves power at the engine-house. It is not meant that the car going up needs less power than if another method of haulage were adopted, but that part of the total power it absorbs is supplied by the gravity of the car coming down hill on the other line. The whole of a cable tramway over a hilly route thus requires little or no more power at the engine-house than if the route were level. This is a unique advantage of cable traction for hilly routes. When horse, steam, electric or other power is used the gravitating power of the cars down hill is dissipated in the brakes, while with the cable system it is conveyed to the cable to help to pull the ascending cars up hill. Readers interested in this branch of the subject can easily calculate for a given hilly route the enormous power

* From *Railway World*, London.

(allowance being made for the mechanical efficiency of the system) which must be provided for each car when any form of traction other than cable is employed. It is of course understood that the advantage from this point of view of cable haulage does not become fully apparent unless the service of cars is a frequent one. On nearly all cable lines, however, the last condition is fulfilled.

COMMERCIAL FORMS OF ELECTRICAL RESISTANCES USED FOR LIGHTING AND POWER PURPOSES.*

BY L. B. ATKINSON.

(*Concluded from page 102.*)

It may be well now to describe and illustrate forms of resistance embodying the arrangements already set forth.

Fig. 1 shows the old fashion wooden resistance box, with wire coils. Figs. 2 and 3 show the original fire-proof resistance designed by the author in 1886. Figs. 4, 5 and 6 show other forms of resistances using coiled wires. In all these the wires are carried in an iron frame, either on slate strips or on porcelain insulators, and a multiple switch, with connections to the wires, enables more or less of the resistance to be put in circuit.

Fig. 7 shows a form of carbon resistance.

These resistances are useful for experimental work, but they will not carry or dissipate any large amount of power.

In Fig. 7 the resistance is shown in an iron frame screwed up from one end, such a form however being only useful for low resistances and large currents,

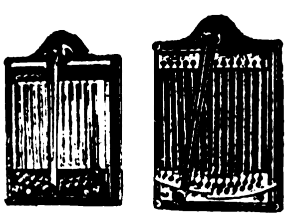


FIG. 4.

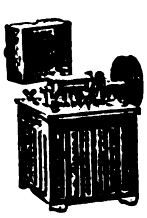


FIG. 5.

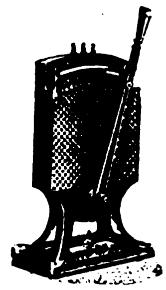


FIG. 6.

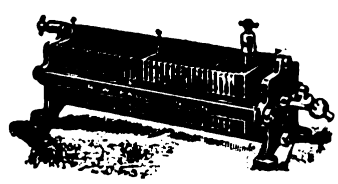


FIG. 7.

the specific resistance of carbon being too low except in this case.

Figs. 8 and 9 show various forms of resistance designs by the writer, in which the new material "relugite" is used.

In Figs. 8 and 9 the top and bottom plates are of iron, enamelled on the inside; there is a central bolt

FIG. 8.

FIG. 9.

also insulated by enamel, and a pile of plates alternately of the material and of metal lies between these plates, and the pressure is adjusted in Fig. 8 by a handwheel and in Fig. 9 by a nut.

Figs. 10, 11, 12 and 13 show various forms of liquid resistances; Fig. 10 is a form used for laboratory purposes, and with a dilute solution of zinc sulphate may carry as much as 2,000 volts between the electrodes.

Fig. 11 shows a form used for motor starting; the segment forming one electrode is shown partly immersed, the outer casing, which is of iron, forming the second electrode.

When completely immersed, a contact on the segment support short circuits the resistance entirely.

* Paper read before the Northern Society of Electrical Engineers at Manchester, Eng.

Fig. 12 shows a form of liquid resistance which the writer has used, the current entering at the bottom of one tube and leaving at the bottom of the next tube, a wire fork or bridge being raised or lowered in the tubes.

A curious phenomenon occurs with such an arrangement, the complete explanation of which the writer is unable to give, viz., that using lead plates at the bottom of the tubes and a copper or iron

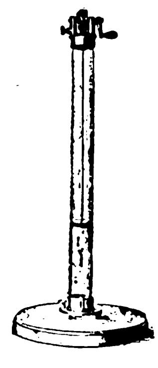


FIG. 10.

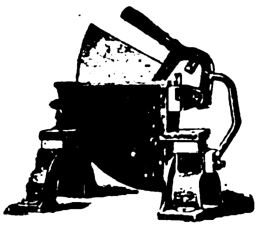


FIG. 11.

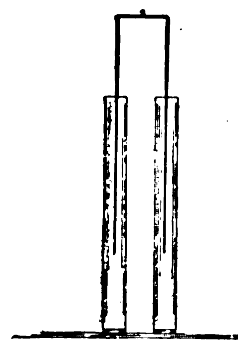


FIG. 12.

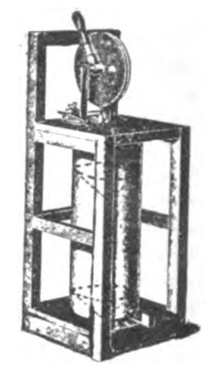


FIG. 13.

bridging piece, the resistance and heating effect is not equally divided between the tubes but is largely concentrated in one of them.

Fig. 13 shows a form of liquid resistance used for lowering lights for theatrical purposes, and consists in an earthen pot or jar, at the bottom of which is a lead cone, another lead cone being raised or lowered in the jar. These are shown by dotted lines.

Fig. 14 shows a form of resistance generally used for motor starting only, as the cooling surface is small, in which the wires are embedded in asbestos, enamel or cement; this will be referred to again.

ADAPTATION OF RESISTANCES FOR SPECIAL PURPOSES.

Resistances for Regulating Dynamo and Motor Shunts.—Almost any of the forms which have been described are suitable for this purpose. As to capacity, the maximum amount of power to be dissipated is reached when the resistance is equal to the resistance of the shunt, and when the current comes down to half its original value.

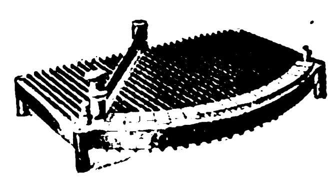


FIG. 14.

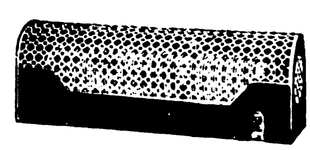


FIG. 15.

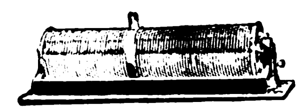


FIG. 16.

Resistances working by compression, and therefore

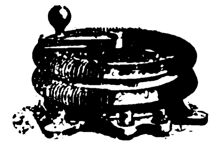


FIG. 17.

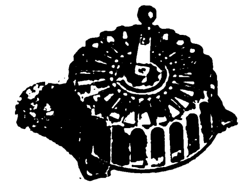


FIG. 18.

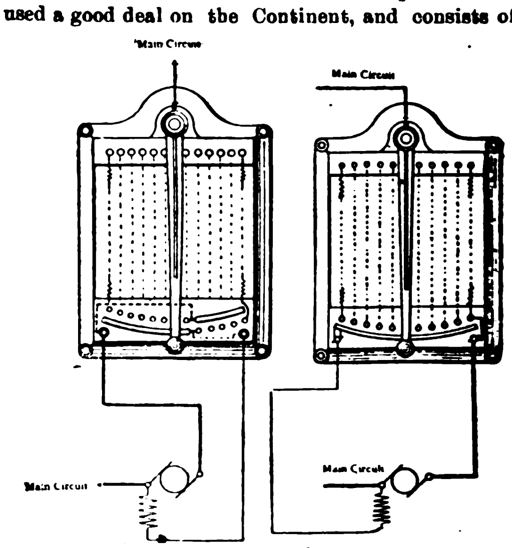
giving a perfectly steady graduation between maximum and minimum, have the advantage of allowing the EMF. to be regulated very exactly, an advantage where dynamos are being run in parallel.

Arc Lamp Resistances.—These form an important class, as very large numbers of them are used.

Fig. 16 shows the usual form, consisting of a porcelain cylinder, having a spiral upon it, in which is wound a german-silver wire. The resistance is regulated by a movable clamp placing more or less of the wires in circuit.

Fig. 15 shows the same arrangement, with a perforated cover to allow of ventilation.

Figs. 17 and 18 (which is the same resistance with a cover on it) shows a form of arc lamp resistance used a good deal on the Continent, and consists of



Starting resistance with shunt regulation. Starting resistance without shunt regulation.

FIG. 19.

two earthenware disks, having a groove on the periphery, round which a wire coil is stretched.

The adjustment is made by a movable contact sliding over one of the coils.

Resistances for Lowering Lamps.—These are mostly used for stage effects, and if made with switches should have a large number of contacts to make the graduation imperceptible, or liquid resistances or resistances worked by pressure variation should be used.

Owing to the peculiar nature of the fire risks in the theater, special care should be taken that the rise of temperature should be small.

In the case of resistances designed by the writer for the Drury Lane Theater, the specification was that the resistances should not rise more than 80° F. above that of the atmosphere.

Resistances for Meter and Instrument Testing.—For this purpose resistances with sliding wire, or liquid resistances, have been generally used, enabling the current to be kept at an *exact* value. A "relugite" pressure resistance is now being adopted for this purpose. It has the additional advantage with al-

ternate currents that the resistance being inductionless no errors are introduced.

Motor Starting Resistances.—It has frequently been a subject of complaint that the resistances for starting both continuous current and multiphase motors, particularly for small powers, cost almost as much as the motor itself. This has been largely due to want of standard designs specially suited for the purpose.

In general the resistance is not required for more than say one minute, but should be capable of carrying the full load of the motor for that time. Some forms recently introduced will only carry the load for 20 seconds; this is not safe.

Fig. 14 shows a form of resistance specially adapted for this purpose.

Fig. 5 shows a form in which the resistance is gradually removed by the motion of the motor after starting.

For the purpose of regulating the speed of motors the resistances must be made larger, and must be capable of carrying a load depending on the range of regulation, but if this is a wide one practically the full load of the motor must be provided for. The simplest way of regulating the speed of a shunt motor is shown in the right hand diagram of Fig. 19 where a resistance is placed in circuit with the armature of the motor, the full line pressure always being on the shunt coil. The left-hand diagram of Fig. 19 shows a modified arrangement, in which part of the speed regulation is effected by varying the strength of the current in the magnet coils. In this case the method of working is to have, in the first instance, the full line pressure on the magnet coils and resistance in the armature circuit. The resistance is gradually taken out of the armature circuit, and resistance is then inserted in the magnet circuit, thus weakening the field and allowing the speed to rise.

If this form of regulation is to be adopted the magnet windings should be specially arranged for apparatus to have a low resistance, so that the motor is considerably over-excited at starting.

Figs. 11 and 13 show resistances also well adapted for motor starting, and pressure resistances filled with either carbon or "relugite" are also used for this purpose.

In order to avoid the possibility of a motor being switched into circuit rapidly, it is preferable to fit such resistances with a screw motion, but if this is done, arrangements must be made by a separate switch or otherwise, so that the circuit can be broken instantaneously in the case of accident or emergency.

An important point in connection with regulating resistances, particularly where the variation in resistance from point to point is considerable, is the question of the switch contacts, as considerable sparking occurs on the contacts which from this cause becomes dirty or roughened, and causes considerable trouble.

In a form of switch pillar for starting and regulating speed of motors designed by Messrs. Royce independent quick break contacts are fitted at each resistance point, and the final break is effected by a carbon contact. In a form designed by Pochin, the switch arm itself carries a small wiper which takes the spark and may be renewed as required.

In the case of pressure resistances these precautions are unnecessary, and even in the case of resistances with multiple contacts and filled with "relugite" material, owing to the fact that such resistances are inductionless, the spark on the contacts is practically eliminated.

CONCLUSION.

In conclusion, the writer desires to point out the advances which have taken place in the last few years in the design and manufacture of resistances, owing largely to the increased demand, and therefore to the specialization which this has allowed, and hopes that the notes contained in the foregoing paper will prove of interest to the members of the Northern Society of Electrical Engineers, who have doubtless had considerable experience not only of the merits, but of the disadvantages to which this class of apparatus is liable.

From a manufacturer's point of view, it is greatly to be desired that engineers designing plants will endeavor to avail themselves of manufacturers' existing patterns and standards rather than to specify for particular arrangements, as it is only in this way that the cost of accessories of the electric light and power plants can be brought to a point which will have the effect of greatly stimulating the use of electrical appliances in many cases where at present the admitted advantages do not outweigh the expenditure necessary.

MINES RUN BY ELECTRICITY.

The Canon City-Cripple Creek Power Transmission Plant in Operation.

The following letter from a correspondent of ELECTRICITY in Canon City, Col., gives an interesting account of an event of more than ordinary importance to the mining interests of Colorado:

At noon on the 17th inst. Governor Alva Adams pressed the button which was the means of putting in motion the massive machinery of the Colorado Electric Power Company at Canon City, the electrical current being transmitted to motors at the Cripple Creek gold mines, 24 miles distant, where arrangements have been carried out to have them take the place of the usual steam power equipment that has heretofore been in use. This means the successful accomplishment of another big undertaking which adds to Cripple Creek's greatness as the foremost gold-producing camp in the United States and at the same time records another instance where electricity was considered as the model power for mining purposes by a community of practical men.

The occasion was witnessed by 400 prominent mine-owners from Colorado and other parts of the country. After a thorough inspection of the plant had been made, the visiting mining men were dined and Governor Adams delivered an address on what the new enterprise meant for Cripple Creek in particular and the State of Colorado in general, which completed the installation of the new plant.

In brief, the scheme is to generate electricity at Canon City, which is in the midst of extensive coal fields, and transmit the power to Cripple Creek, where coal, which is a prime necessity in the running of the mines, sells at a high figure. This will enable mines to be operated at a profit that have heretofore been close to losing properties, and at the same time effect a very great saving in running expenses with the large producers. It promises to be a very important point in the future development of the camp.

The plant is one of the largest and best equipped electric power concerns in the West. The equipment consists of three Hamilton-Corliss engines, with a combined strength of 9,000 HP., direct connected to three Westinghouse three-phase generators of 2,100 kilowatts capacity, wound for 500 volts, making three separate generating units, one of which will always be kept idle as a reserve in case of an emergency. For exciting the fields of the main dynamos there are two "Kodak" exciter outfits, each of which is capable of exciting all three of the main dynamos; one of these exciter outfits will always be kept in reserve for emergencies.

The engines are supplied from a battery of Heine safety tube boilers and the exhaust steam is taken care of in a surface condenser. The air and circulating pumps and feed pumps are all of the Snow make.

There have been installed at the main station four transformers that step up from 500 to 20,000 volts, at which pressure the current is delivered to the transmission line. The first sub-station is near Victor, on the saddle between Battle Mountain and Bull Hill. The location of the second sub-station is on the saddle between Gold Hill and Globe Hill, near Cripple Creek. At each of the sub-stations the current steps down by means of transformers to 500 volts, at which pressure it is delivered to the motors in the mines.

In addition, lights are to be supplied from the same wires used to furnish power. One of the prominent features in the construction of this plant is the insuring of continuous service. The machinery and construction are of the very best, and ample reserve capacity is carried throughout. The construction of the transmission line is substantial, and particular pains have been taken to protect it from lightning troubles. In addition to the lightning arresters in the generating station at Canon City and in the sub-stations, lightning arresters have been installed at a number of points along the transmission line, the "Wurts" arrester being adopted throughout.

It should be added that in addition to the 24 miles of line between Canon City and Cripple Creek there is about six miles of line over the camp, which will make the total length of the system about thirty miles. The work of constructing this system was commenced last September, and after not quite 12 months everything is in readiness.

The entire line is patrolled by experienced line men who carry with them a telephone specially adapted for their work which they can connect with the main line at any point and send in word wherever they find a break. Western Union call boxes are stationed along the line, and through them the patrolman must report where he is every hour.

The main station of the Colorado Electric Power Company's plant is a substantial structure 140x106 feet, constructed of brick, stone and cement, with steel trusses and corrugated iron roofing, and allowance has been made so that the entire plant can be duplicated without the addition of another smoke stack or extra condensers.

This plant has cost an enormous sum of money, probably not less than $750,000. The company is made up of such capitalists as John D. Rockefeller, Andrew Carnegie, the Westinghouse Company, etc.

The transmission line was erected under the supervision of the Mountain Electric Company of Denver, for which they used a specially designed insulator gotten up by them. This company by careful and painstaking work has gained a reputation as being second to none in this section for transmission construction work. The generating apparatus was installed by the Westinghouse Company and the steam equipment was put in under the supervision of the Stearns-Rogers Company of Denver.

It has been carefully computed that there will be a saving of 30 per cent. in the operating expenses of the mines if electricity is used, in so far as the matter of hoisting the ore, running drills and doing whatever steam can do is concerned. Then again there can be no argument brought against the convenience. In the place of unwieldy steam boilers that are getting out of fix every now and then, a trim little motor, perhaps 3x5 feet, does the work. There is no dust, no grease, no lugging coal up the sides of mountains to the mines, and no breakdowns. But this last point suggests another—will there be no breakdowns? It has been gathered from statistics that the experience of the Fresno, Cal., plant is typical of all; in that instance during two years that the plant has been in operation there has been but three stops—two for five minutes and one for twenty minutes—in all thirty minutes.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

ANNUAL MEETING OF THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The eighth annual meeting of the American Electro-Therapeutic Association will take place in Buffalo on the 13th, 14th and 15th of September. The business sessions of the Association will be held in the rooms of the Buffalo Society of Natural Sciences, Public Library building. The Buffalo *Commercial* contains the following interesting particulars of the approaching meeting:

An exhibition of electrical apparatus for diagnostic, therapeutic and radiographic work will be one of the interesting features of the Convention. A large number of entertainments will be provided by the local committee of arrangements, including tallyho drives about the city daily, a public reception on Tuesday evening (13th), an excursion down Niagara river and a reception at the Island Club, Grand Island, with a number of other receptions, visits to industries of interest, etc. Special hotel rates will be secured at Niagara Falls as well as in Buffalo for all attending the Convention.

A preliminary programme has been arranged for the Convention, embracing a large number of interesting topics. Time will be given to a series of ten-minute discussions on electro-therapy, of special interest to the general practitioner, including the following subjects: "Effect of Electricity on Tissue Metabolism," "Electro Diagnosis," "Diseases of the Nervous System," and other topics.

Among the papers promised for the Convention are some by the most noted writers on medical topics in this country, and several physicians of Europe who are acknowledged international authorities on their special subjects.

Dr. Apostoli of Paris, France, will present a paper entitled "Notes on New Applications of the Sinusoidal Currents in Electro-Therapeutics."

Dr. Gautier, also of Paris, will present several subjects before the Convention, as follows: "The Hydro-Electric Bath with Sinusoidal Current in Disease," "On the Value of Hot Air and Light Bath in Disease," "Two Years of Practice in Radio-Therapy," "Electro-Therapy in Gynecological Applications."

"Electricity in the Cure of Uterine Fibromyomata" will be the subject of a paper by Dr. Felice La Torre of Rome, Italy.

Dr. J. Inglis Parsons of London, Eng., will present a paper on "The Effect of High Tension Discharges upon Micro-Organisms."

A paper which will be heard with wide interest will be presented by Nikola Tesla, on "High Frequency Oscillator for Electro-Therapeutic Purposes."

Buffalo will be represented on the programme, Dr. William C. Krauss reading a paper on "Case of Lightning Stroke without Serious Consequences," and Dr. Lucien Howe, Buffalo's celebrated oculist, speaking on "The Method for Using Cataphoresis in Certain Forms of Conjunctival Inflammations."

Dr. John O. Doe of Rochester, N. Y., will read a paper on "The Uses of Electricity in Diseases of the Nose and Throat." J. J. Carty, E. E., of New York, will speak on "Some Suggestions on the Possibilities of Cataphoresis."

"The Electric Light Bath" will be the subject of a paper by Dr. J. H. Kellogg of Battle Creek, Mich. Dr. M. A. Cleaves of New York will treat on "Metallic Electrolysis, with Laboratory Experiments," also on "Electrical Treatment of Inflammatory Exudates."

"Electricity in Gynecology" will be the subject of a paper by Dr. W. J. Herdman of Ann Arbor. Dr. A. D. Rockwell of New York will speak on "Diagnostic and Therapeutic Relation of Electricity to Diseases of the Central Nervous System."

Another paper from a Buffalo man will be by Dr. Grover W. Wende, who will speak on "Electricity in Acne Vulgaris and Acne Rosacrae."

"Cataphoric Action of the Galvanic Current" will be the subject of a paper by Dr. Caleb Brown of Sac City, Ia.

R. G. Brown, E. E., of Brooklyn, will present two subjects before the Convention, "New Electric Light for Diagnostic Purposes," and "Surface Electrodes, How They Should be Made; Connector Cords, How They Should be Made and Insulated."

Dr. Robert Newman of New York will speak on "Electricity in Deafness and Strictures of the Eustachian Tube." Dr. R. J. Nunn of Savannah, Ga., will speak on "Treatment of the Uterine Fibroids by Small Currents Administered Percutaneously."

"Treatment of Certain Muscular Affections by Means of Electricity" will be the subject of a paper by Dr. William F. Robinson of Albany. "True Status of Electricity and Allied Remedies in Treatment of Strictures and Prostatis" will be dealt with by Dr. G. W. Overall of Memphis, Tenn.

Dr. W. S. Watson of Fishkill-on-Hudson, N. Y., will speak on "Electricity and Medical Institutions." Dr. W. H. White of Boston, Mass., will present a paper on "Static Electricity in Nervous Diseases." Dr. H. S. Jewett of Dayton, O., has for his subject "The Misuse or Abuse of Electricity as a Therapeutic Agent." Dr. W. Schepp grell of New Orleans, La., will speak on "Electricity in Diagnoses of Disease of the Ear." Dr. W. H Harris of Toronto will present a paper on "X Ray Burns." Dr. F. B. Bishop of Washington, D. C., will speak on "High Tension Current in Neuritis."

All members of the medical and electrical professions are invited to the meetings of the Association.

The exhibition of apparatus, etc., will be held in the Public Library Building, and this will also be open to the public.

The present officers of the Association are as follows:

President—Dr. Charles R. Dickson of Toronto.

First Vice-President—Dr. Frederick Schavoir of Stamford, Conn.

Second Vice-President—Dr. Caleb Brown of Sac City, Ia.

Secretary—Dr. John Gerin of Auburn, N. Y.

Treasurer—Dr. Richard J. Nunn of Savannah, Ga.

Executive Council—Dr. Robert Newman of New York, Dr. G. Betton Massey of Philadelphia, Dr. William J. Morton of New York, Dr. William J. Herdman of Ann Arbor, Dr. William T. Bishop of Harrisburg.

Committee on Arrangements at Buffalo—Dr. Ernest Wende, chairman; Dr. W. W. Potter, printing; Newcomb Carlton, E. E., exhibits; Dr. Roswell Park, Dr. Herman E. Hayd, Dr. Henry R. Hopkins and Charles R. Huntley.

Ohio Electric Light Association.

The fourth Annual Convention of the Ohio Electric Light Association was held at Sandusky on the 19th and 20th inst. Fifty delegates were in attendance. Several papers were read and discussed and much interest was shown in the proceedings. On the 20th the members enjoyed a trip to Put-in-Bay as guests of the Sandusky Gas & Electric Company. Officers for the ensuing year were elected as follows:

President—Emil G. Schmidt, Sandusky.

Vice-president—B. P. Holmes, Youngstown.

Secretary-treasurer—Samuel Scovil, Cleveland.

Executive Committee—H. K. Wood, Piqua; B. P. Foster, Norwalk; George Matt, Lancaster; E. H. McKnight, Middletown; S. Griffin, Lorain.

The next Annual Convention will be held at Cleveland upon dates to be fixed by the Executive Committee.

LEGAL NOTES.

The Grand Rapids *Herald* states that Judge Severens has rendered a decision in the Lowell Water & Light Company case granting the application for a receiver. Some time ago the company placed its business in the hands of the Michigan Trust Company, which was against the wishes of the creditors, and they commenced suit to force the appointment of a receiver and have been successful.

On the 24th inst. Judge Lacombe issued preliminary injunctions restraining the Nassau Electric Railroad of Brooklyn, N. Y., from the further use of electric controllers made by the Steel Motor Company, and against the Walker Company enjoining its manufacture of the several types of car controllers manufactured by it. The operation of this injunction is suspended until the next session of the Court of Appeals, to give the defendants an opportunity for appeal.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING PLANTS.

Albany, N. Y.—The cost of lighting the Capitol under the existing contract with the Municipal Gas Company is $42,000 a year for electric lights and $14,700 a year for gas. There are 10,600 incandescent lights in the building, 56 arc lights on the grounds, and one of the elevators is run by electric power. With this great number of lights the service is not entirely satisfactory, and changes are contemplated which may result in the installation of an independent plant.

Carthage, Mo.—At an election held here on the 16th, the citizens expressed themselves as opposed to letting out any more contracts for city lighting to private corporations. The vote stood 244 for to 311 against.

Centreton, N. J.—The Parvin Mills, near here, have been sold to Philadelphia capitalists for $10,000. It is understood that an electric light plant will be placed there to light the surrounding country.

Covington, Ga.—A contract was made by the city with an electric light company in March last for lighting our streets with electric lights, but the company has since failed, and the council is now being urged to make an effort to secure another company to undertake the work.

East Greenville, Pa.—A movement has been on foot for several weeks to utilize the immense water power at the large dams of the J. C. Hancock Ice Co., at Green Lane, to operate an electric light plant. It is proposed to extend the plant to Sumneytown, Red Hill and the boroughs of Pennsburg and East Greenville.

Fergus Falls, Minn.—Superintendent Peterson of the electric light plant is preparing to put in new "leaders" which will give the plant a capacity of over 4,000 lights. The electric light system is owned by the city and is one of the finest in the Northwest.

Frankfort, Ky.—The State officials are taking steps to light the State buildings with electricity and will have a plant erected at the Penitentiary.

New York.—It is reported that the Metropolitan Street Railway Company has been quietly laying a large underground conduit in the excavations making for its underground trolley in Sixth and Eighth avenues, and that the conduit is to be used in a proposed electric light scheme under contemplation. The company has enormous power plants, and a slight addition to them, it is said, will be sufficient to furnish electric lights for a large part of the city.

Pittsburg, Pa.—The local papers state that the indications are that on the occasion of the triennial conclave of the Knights Templars, October 12, Pittsburg will give "the most unique, elaborate and wonderful electrical display that has ever been seen in the history of the electrical world."

San Francisco.—The Board of Supervisors has passed over the Mayor's veto the resolution awarding to the San Francisco Gas & Electric Company the contract for lighting the city for the next two years.

Silver City, N. M.—C. L. Slack is pushing operations on the electric light plant here and poles will be erected and wires strung in the principal streets in a few days.

Tallahassee, Fla.—The city council has passed a resolution "that steps should be taken immediately for the establishment by the city of an electric plant for lighting the streets and other public places of the city as will pay for such use."

Two Harbors, Minn.—The village recorder advertises for bids for $8,000 electric light bonds issued in denominations of $1,000, bearing interest of 6 per cent. per annum. Bids will be received until September 12.

Woodsfield, O.—The city council has decided to abandon the plan of lighting the streets by natural gas and is making investigations as to the cost of electric lighting.

STREET RAILWAYS.

Ann Arbor, Mich.—It is reported here that a corps of surveyors have been working east of Ypsilanti laying out a new electric road to parallel the Detroit, Ypsilanti & Ann Arbor line. It is said that the Michigan Central Railroad is promoting this new road, having found the competition of the electric road very severe.

Boston.—On the 19th inst., the first regular passenger car that ever passed over the entire trackage of the Boston subway accomplished the feat with complete success. The delegates to the annual convention of the Society for the Promotion of Engineering Education, then being held in the city, witnessed the test with the deepest interest and with apparent admiration.

Buffalo, N. Y.—The Buffalo, Kenmore & Tonawanda Electric Railway has been sold to Morris Cohn. The road is about five miles long and was built four years ago. The price was the amount of bonds held by Mr. Cohn, $63,147, and the amount of the claim of the assignees, $28,000, which the purchaser has agreed to satisfy.

Byron, Ill.—The voters of this place at a special election have declared in favor of granting the Rock River Electric Railway Company right of way through the streets.

Corsicana, Tex.—It is reported here that negotiations are now on foot that will result in the building of a street railroad in this city. It is said that the plans have about been perfected and that the line will be in operation before many months.

Elizabeth, N. J.—It is authoritatively stated that ex-Congressman John Kean, who bid $250,000 for the boulevard franchise, will at once transform his horse railroad in this city into an electric road and expects to complete the change by November 1.

Jasper, Ind.—Ferdinand, a nearby German town of 1,000 inhabitants, not incorporated, has an electric plant now under construction, and the preliminary steps have been taken to run an electric car line to Jasper.

Kansas City, Kan.—The city council has passed an ordinance providing for the changing of the Fifth street cable line into an electric system.

Lewiston, Me.—A correspondent of the "Journal" at York states that a prominent Boston & Maine official made the remark that within a year the Boston & Maine Railroad will operate by electricity the Portsmouth & Dover branch, the York Harbor road and a Portsmouth street line, with a joint power house on Nobles island in the Piscataqua river.

Northville, Mich.—A movement is on foot here to organize a stock company among business men to construct an electric railway from Northville to Novi, Walled Lake, Wixom, New Hudson, South Lyon, Salem and back to Northville. It is to be called the Northville Belt Line and will be in the nature of a circle. It will be about thirty miles in length. The farmers have agreed to do the grading free.

Nyack, N. Y.—The "Star" states that the Nyack Traction Company has sold the Nyack, South Nyack, Upper Nyack, Grand View, Piermont and Clarkstown trolley franchises to some Philadelphia capitalists, who intend to build the road. The franchises stipulate that the actual work of building the road must be commenced by November 18 or the franchises will become null and void.

Oakland, Cal.—It is announced, says the "Enquirer," "that at the next meeting of the city council a petition will be presented for permission to substitute electricity for the cable system now in use on the San Pablo avenue and Broadway line. Should the petition be granted it is believed it will be the forerunner of an entire change in the Southern Pacific Company's local passenger service. The ultimate plan is supposed to include the substitution of electricity for steam as a motive power on the entire system, including the Alameda and Berkeley local roads, the narrow gauge and the Seventh street line. A monster power house would be one of the necessary requisites."

Providence, R. I.—The Taunton & Providence Electric Railway line was formally opened on the 22d inst. by an excursion on the cars which was followed by a clambake provided by the managers.

Rochester, N. Y.—The Rochester & Sodus Bay Railway Company has completed its organization by the election of officers as follows: President, T. J. Nicholl; vice-presidents, first, J. C. Tone, second, Walter B. Duffy; treasurer, John H. Gregory; secretary, Charles Van Voorhis. The road will be about 42 miles long and is to be of the same general character as the electric roads running out of Buffalo, Cleveland, Detroit and other cities.

Sedalia, Mo.—The Citizens' National Bank of this city has sold the stock of the Sedalia Electric Railway, Light & Power Company and the Sedalia & Brown Electric Railway Company to Stewart & Co. of New York. The consideration was $400,000.

St. Louis.—The "Globe-Democrat" states that J. D. Houseman, Jr., the electric railroad promoter, who projected and built the "Houseman Air Line" from St. Louis to Meramec Highlands, is at the front with another big railroad project—the construction of a line from Robringville along the Telegraph county road to the Meramec river, and from there direct to Kimmswick, on the Iron Mountain road, about twenty miles from the St. Louis Court House.—The same paper says that the Illinois Central Railroad Company has announced officially the opening of an electric line between East St. Louis and Belleville. They will use the old St. Louis, Belleville and Southern road which will be equipped with the third rail system. The difficulty is the use of the road as an electric line and also as a railroad line; as this is the only outlet of the Crown coal lands, it will necessitate the running of freight trains over the new electric line.

Waupaca, Wis.—The Waupaca Electric Light & Railway Company has filed a trust deed to the Milwaukee Trust Company for $42,000, which gives assurance that the trolley line from Waupaca to Chain o' Lakes will be built as promised.

Watertown, N. Y.—William P. Casey, of Syracuse, has organized a company to build and operate a trolley line between Watertown and Sacket's Harbor. The amount of capital stock is $100,000. The directors for the first year are as follows: William P. Casey, James S. Luddington, James H. Kinney, H. D. Barto, Syracuse; Joseph Marrian, G. Harrison Smith, John E. Bergevin, Watertown; S. Harland Wetmore, Leyden; William H. Reese, Evans Mills. The principal office of the company is to be located in Watertown.

Wichita, Kan.—The mayor refused to accept the certificate of deposit for $10,000 tendered by W. Q. Church of New York as a guarantee for the faithful observance of the terms of the franchise granted him for a street railway in this city, and the franchise is held in abeyance. It now seems probable that the franchise will be annulled, the streets cleared of the present line and bonds voted for a new line to be constructed by the city at once.

MANUFACTURING, ETC.

Dublin, Ire.—The system of the Dublin United Tramways is being converted to electric traction, formerly having been operated by horse power. The first section completed is the Clontarf line, extending from Dublin through the suburbs, a total distance of about 6 miles. On this section the introduction of the trolley was signalized by a reduction of fares to a trifle more than half what they had been, notwithstanding which receipts increased 38 per cent. and working expenses were reduced from 71.76 per cent. with animal power to 47.69 per cent. under electric traction. The present population of Dublin numbers about 600,000.

Malaga, Spain.—A new company, the Nueva Sociedad de Electricidad Peeters, chiefly formed by German capital, is going to establish a permanent service of electric lighting in this city, considerably reducing prices which have ruled hitherto. The price per annum, paid in monthly instalments, is: 16-candle lamps, 38 pesetas; 10-candle lamps, 32 pesetas.

New York.—The "Journal of Commerce" states that on the 24th inst. a New street firm purchased, among other manufactured articles, $11,000 worth of electrical apparatus for shipment to Mexico, and also that electrical materials amounting to upwards of $10,000 were shipped to that country previously in the week.

San Antonio, Tex.—The city council has adopted an ordinance governing electric wiring, a provision of which forbids the use of what is known as "white" or "underwriter's" wire.

Washington, D. C.—The Navy Department is inviting sealed proposals until September 13 for furnishing the Norfolk, Va., Navy Yard with two direct-connected electric generating sets, one switchboard, and thirty lightning arresters. Prospective bidders desiring specifications and blank forms of proposals can obtain same upon application to the Navy Pay Office at Norfolk or to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.—Consul-General Goodnow sends the following item, relative to the proposed electric street railway of Shanghai, China: The electric overhead trolley system is to be adopted. A concession is to be given for the construction of the line and all accessories to a syndicate or company, to be known as the Shanghai Tramway Company. The concession is to be for thirty, forty or fifty years according to the tender that the ratepayers may decide to accept, and the company is to pay the council a percentage of the total gross receipts for the period of the concession. Notification to tenderers by public advertisement will follow in due course, and the tender finally selected will be submitted to the ratepayers for ratification.

TRANSMISSION PLANTS.

Charleston, W. Va.—The Wilson Aluminum Company, which was chartered some years ago, and which purchased the land on each side of the Kanawha river at Kanawha Falls, is about to begin at that point the construction of a water power plant to generate electricity for the running of all kinds of machinery in the Kanawha Valley, principally mining machinery and electric lights.

Colorado Springs, Col.—The opening of the Colorado Electric Power Company's plant at Canon City is of great importance to the Cripple Creek district. The "Gazette" says: "It is the first attempt in the Rocky Mountain region to use the product of the coal mines near the place of origin for the production of electricity to be used at a distance. In effect it places the cheap coal of the Arkansas Valley at the door of every shaft house in Cripple Creek. It emancipates the miner from the difficulties of obtaining water for the boiler as well as fuel for the furnace, and decreases very materially the amount of heavy machinery which has to be hauled over the steep hills of the district. The successful and profitable operation of the Canon City enterprise will lead to the establishment of similar plants elsewhere, operated either by steam or water power, which will greatly increase the production of established camps and make possible the profitable operation of others which cannot be worked under the present conditions."

Lake City, Col.—The Denver, Col., "Times" says: "Work has commenced on an enormous electric power transmission plant that will utilize water that has gone to waste for centuries. Lake San Cristobal is being dammed up and made to yield force almost beyond calculation, for by a dam fifteen feet high by less than 150 feet long more than 1,675,000,000 cubic feet of water will be stored, and in addition, a ditch five feet deep will render available, according to the calculations of experts who have examined the place, 52,272,000 cubic feet more, and all this may be used at a head of 150 feet although at present much less fall will be utilized. Mines will be lighted and worked by electricity."

Lowville, N. Y.—The Wetmore Electric Company, which has just been incorporated with a capital stock of $40,000, was formed for the purpose of erecting electrical generating works at Belfort on the Beaver river, there being abundance of water power there. The electricity produced will be transmitted to Lowville for lighting and other purposes, the company having obtained a franchise from the trustees. The directors of the Wetmore Electric Company are Oliver P. Hedden and Jacob Strife of Lowville, Supervisor Thomas Glenn of Croghan and George W. Pulver of Syracuse. Mr. Pulver is connected with the Westinghouse Electric & Manufacturing Company.

COMPANY MATTERS.

Sioux City, Ia.—The Electrical Supply Company of Sioux City has doubled its capital. E. C. Spalding has been elected treasurer and purchasing agent, and H. O. Woodruff has taken a position on the road. This company has had a good business and now, with ample capital, it is going to push both jobbing and construction work.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—The New York Civil Service Commission announces that open competitive examinations will be held in several cities in the State, September 24, for various positions, among others that of assistant electrical engineer.—For the first time on the evening of the 25th inst. the Capitol was fully illuminated in honor of the full completion of the building. It was a brilliant display, as all the electroliers along the front and side of the immense building were fully displayed, as well as those on the massive front staircase, each of which sent forth such a flood of light that a newspaper could be read in any part of the park. The beautiful illumination attracted the attention of crowds of people, all of whom expressed admiration and approval. The electroliers and fixtures were furnished by Mitchell, Vance & Co. of New York City. They are of heavy bronze of most artistic design and finish. The display was magnificent.

Cohoes, N. Y.—The Cohoes Electric Light Company is making arrangements to furnish electric power during the day. Three large new water wheels will be set in position, and several large electric generators will also be put in; power will be supplied throughout the city. It is expected that the plant will be in running order by November 1.

Hudson, N. Y.—The Frisby water power at Stuyvesant Falls has been purchased by the new owners of the Kinderhook & Hudson Railroad. This will be used to run the dynamo which will generate power for the electric cars. The cost of this water power, said to be the best in that portion of the State, was $125,000. The fall from the upper dam is 130 feet, and water will be taken from that point through a steel trunk. The company intends to furnish power for mills and to supply electric light for the neighboring villages.

Schenectady, N. Y.—The employes of the General Electric Company had an excursion to Sacondaga Park August 27. These included the men employed in machine shops 8 and 10 and the experimental department, No. 11, as well as the armature department, No. 15. Fifteen cars were used to convey the excursionists to their destination.

PERSONAL AND MISCELLANEA.

John D. Rively, an inventor of electrical appliances, among them a storage battery for which he made extraordinary claims, died at Pittsburg on the 22d inst.

Walter F. Ford, president of the Winchester Avenue road, New Haven, Conn., died at Pemberton, Mass., on the 17th inst., of apoplexy.

Incandescent electric lights can be inserted in or removed from sockets at considerable height by a new appliance consisting of a long pole to which a metal socket is attached, carrying wires which support a spring clip to encircle the metal base of the globe and hold it while being screwed into position.

A new law regarding transfer tickets on street car lines will go into effect in New York State on the 1st of September. It is applicable to every city in the State in which street cars are run and makes it a misdemeanor for a passenger who has received a transfer to give it away to another person who has not paid his fare, and it will also be a misdemeanor for the latter person to offer it in payment of or in lieu of his fare.

Harvey Hoag, of 514 Massachusetts avenue, Buffalo, N. Y., is the inventor of a contrivance that may have an important effect on the building of trucks for electric cars. He has invented a ball-bearing truck, and the Buffalo "News" says the officials of the Buffalo Railway Company think so well of it that they have allowed him to equip one of their cars with the device. It has been on trial several days and has worked satisfactorily. Mr. Hoag claims his invention will considerably reduce the power necessary to run an electric car.

Nanticoke, Pa., was the scene of a somewhat remarkable series of electrical accidents on the 19th inst., as the following report from the Wilkes-Barre "Record" of the 20th will show: "Harry R. Crowe was instantly killed at his place of business in Nanticoke last night at 10:40 by an electric shock. He was the proprietor of a restaurant on Prospect street and had just finished scrubbing it out when the accident occurred. He reached up to an incandescent light to turn it out and as he did so he touched the exposed wire and fell to the floor dead. No one seems to be able to explain how he received the current unless it was that the light was out of order, or the wire not properly insulated.—Eugene Alexander of Nanticoke also received a severe shock from electricity yesterday. He went into the

cellar and while reaching for a package of goods his hand touched a live wire. He was thrown to the floor by the force of the shock and it was several minutes before he was able to walk. His hand was badly burned.—It was also reported late last night that an unknown man was killed by electricity while standing against an electric light pole in the city park, Nanticoke."

RECENT COMPANY ELECTIONS.

The National Motor Company, St. Louis. Capital stock, $100,000. Incorporators: Herbert H. Hennegin, Peter Hennegin, Oliver D. Harris, Louis A. Allard and William P. Larew, all of St. Louis.

The Clark-McGaillard Engine Company, Camden, N. J.—to construct complete steam and electric plants. Capital stock, $100,000. Incorporators: Chauncey C. Clark, John W. Stoy and Charles P. Watson.

East Washingt n Traction Railway Company (a new organization), Washington, D. C.—Directors: A. M. Bliss, T. J. Brown, Chauncey Marshall, C. A. Barker, David C. Fountain, George Judd, Hora e Crosier, J. A. Mahoney and E. O. Carpenter.

Gloversville Electric Company, Gloversville, N. Y.—President, James Radford; superintendent, John Begley; secr etary, Edgar A. Spencer.

Steelton Light, Heat & Power Company, Steelton, Pa.—President, Samuel Couffer; secretary, E. C. Keller; treasurer, G. E. Coulson; directors: Samuel Couffer, Jerome Hite, John Hess, F. E. Smith, J. J. Barnet, Dr W. H. Seiber, Joseph Fletcher, Michael Harclerode and G. E. Coulson.

COMMERCIAL PARAGRAPHS.

The New York & Ohio Company, manufacturers of the celebrated Packard Transformer, have recently brought out their latest model which is to be known as "Model 98." The results secured on this new model are something considerably ahead of anything that has been secured heretofore in the way of transformer regulation and efficiency. The Electric Appliance Company, Chicago, general Western agents for the Packard Transformer, are distributing special circulars of the same giving tabulated results of a number of tests. The manufacturers of this transformer are prepared to guarantee these results on each and every transformer sold, and a large fall trade is looked for on the "Model 98."

INCORPORATIONS.

The Wetmore Electric Company, New York—to operate in the towns of Lowville, New Bremen and Croghan. Capital stock, $40,000. Incorporators: George W. Pulver, Jacob Strife, Oliver P. Hedden and Thomas Glenn.

The Saginaw & Frankenmuth Railway Company, Saginaw, Mich.—to build an electric railway. Capital stock, $50,000. Incorporators: Henry C. Potter, Jr., James B. Peter, Samuel G. Higgins and William J. Bartow.

The Iola Rapid Transit & Electric Light Company, Iola, Kan.—to build and operate a street railway from Iola to Humboldt and Moren, and to furnish electric lights for those cities. Capital stock, $10,000. Directors: W. S. Hendricks, George A. Berolas, W. S. Evans, J. E. Chastain, L. L. Northrup, Alfred W. Bach and Eugene K. Taylor.

The Dunmore Electric Light Company, Dunmore, Pa. Capital stock, $50,000. Directors: James E. Watkins of Taylor, Anthony J. Irwin of Dunmore, Abraham Dunning, ex-Mayor John H. Fellows and James O. Vaughn of Scranton.

The Hatboro & Horsham Electric Railway Company, Hatboro, Pa.—to build an electric railway one and a half miles long. Capital stock, $75,000. Directors: Magnus Hellstrom, president, Philadelphia; James Crawford, Alfred R. Grandy, Philadelphia; John B. Peddle, Woodbury, N. J.; S. Edward Hagar, Doylestown.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED AUGUST 23, 1898.

[Inventors of electrical apparatus and appliances are apparently taking a rest. The following comprise absolutely all the patents on devices of an electrical nature issued from the United States Patent Office during the week ending August 23. Never before since ELECTRICITY (now in its fifteenth volume) began publication have we seen so meagre a list of electrical patents in the weekly issue of the Official Gazette.]

MISCELLANEOUS.

609,421. Device for Attaching or Detaching Electric Lamp Bulbs. Charles G. Edwards, Albert Lea, Minn. Filed Jan. 24, 1898.

609,639. Electromedical Apparatus. Reinhold H. Wappler, New York City. Filed Nov. 2, 1897.

609,540 Burglar-Alarm. Daniel L. Wartzenluft, Kutztown, Pa. Filed Nov. 16, 1897.

609,745. Diaphragm for Electrolytic Purposes. William G. Luxton, Liverpool, England, assignor to the United Alkali Company, Limited, same place. Filed April 9, 1898.

DESIGN.

29,265. Battery-Plate. Charles T Richmond, Cleveland, O., assignor to the National Carbon Company, same place. Filed July 18, 1898.

TELEPHONE AND TELEGRAPH.

S. M. English, chief electrician of the Postal Telegraph Cable Company at Galveston, Tex., with a body of assistants numbering twenty men, accomplished a splendid piece of work on the afternoon of the 18th inst. Mr. English, as related in the Galveston *News*, had just completed the laying of the large twelve conductor submarine cable through Galveston bay to Bolivar point and was laying back in an easy chair in the Postal's main office when a message was received from General Superintendent Foster that a wire to New Orleans was wanted for immediate use and asked how soon it could be made ready. Mr. English in a nonchalant way replied that nine miles of wire yet remained to be strung before the connection could be made at Bolivar, but he would take a boat to the point and start the work. He reached Bolivar at 1 o'clock and at 1:30 had his gang and hand car ready to begin. The first hour four miles of wire had been strung, the second hour three miles and a half was covered. At 5 the splice was finished at Bolivar, and Galveston began working with New Orleans for the first time through a submarine cable, the building of the nine miles of wire and forming the cable connection having been completed in the remarkably short time of three and one-half hours, said to be the quickest time ever accomplished in telegraph line building.

The Kinloch Telephone Company of St. Louis, which is getting its entire system in trim for the most efficient service possible, is training its "hello" girls in squads of seven. When one squad is sufficiently trained to make rapid switchboard connections, they become instructors to the next squad of seven, and so on. Each day a matron is employed on the top floor of the Century building, where the exchange is located, testing the oral tones of the fair applicants who wish to become telephone girls. Only those possessing well modulated voices are accepted. Then, the applicant must not be short in stature, for she would not be able to reach the telephone keys. In the room where the switchboard proper is located, a testing of the mammoth instrument is in progress. It is what is known as a divided exchange. There are four sections. Three of these have been tested and it will be only a short time until the fourth and last is ready for operation.

At a meeting of the stockholders of the Cumberland Valley Telephone & Telegraph Company held at Chambersburg, Pa., on the 23d inst., the franchise ordinance as passed by the Chambersburg city council was accepted. Work will be commenced at once. In Chambersburg all the wires will be laid underground. The line will be extended to Fulton, Bedford, Huntingdon, Juniata, Perry, Dauphin, Cumberland and Adams counties, Pennsylvania, and Washington and Frederick counties, Maryland.

The main office of the People's Telephone & Telegraph Company, at present at Allentown, Pa., is to be removed in a few days to Columbia, Pa. This company was organized a few years ago and holds a franchise for the construction of a telephone line in Lebanon. The contract for the erection of the new line has been awarded to the Eastern Electrical Construction Company of Philadelphia and work will be started at once. It is the intention of the People's Company to construct a line to Elizabethtown to connect with the line of the Columbia Telephone Company, which will open communication between Columbia and Lebanon at rates much lower than those at present prevailing. The recently elected officers of the People's Telephone & Telegraph Company are: President, H. C. Young, of Columbia; secretary, A. W. Gieskie, of Columbia; treasurer, M. R. Hoffman, of Marietta.

Codes for telegraphic and cabling purposes have always been a necessity for business men, but their great cost has limited their use. The International Cable Directory Company has solved the problem with its Western Union telegraphic code. This work is the most complete public code in the English language. Over a year was spent in the compilation, which contains nearly 150,000 words, making it the largest public code in existence. The directory of the book contains a list of prominent lawyers of New York, Boston, Chicago, Philadelphia, members of the New York Stock and other Exchanges and cable and business addresses of leading merchants, capitalists and manufacturers throughout the United States.

The Union Suburban Telephone & Telegraph Company of Cleveland filed articles of incorporation with the Secretary of State at Columbus, O., on the 23d inst. It is the purpose of the company to construct telegraph and telephone lines from Sandusky to Painesville, with branches in all the counties of the State. The capital stock is $1,000,000, and the incorporators are H. A. Everett, E. W. Moore, James B. Hoge, Charles W. Wason, Frederick Storm, H. W. McGrew and J. B. Hanna, a brother of U. S. Senator Hanna.

The Southwestern Telegraph & Telephone Company opened a long distance telephone office at Palestine, Tex., on the night of the 16th inst. The company gave an entertainment at the Hotel Nolan, at which fully 150 citizens were present. The guests, with long distance receivers at their ears, heard music in Dallas, Sherman, Houston and Galveston, and many conversed easily over the 'phone with persons at points 600 or 700 miles away.

Plucky Telegraphers.

The telegraph service has never been short of heroes. The erroneous statement in a Reuter telegram on the fight at Manila, that during Dewey's bombardment "cable communication was interrupted, the operators at the station, which is in the midst of the forts, having fled to save their lives," has been disproved in a letter from Manila, which puts the telegrapher in an entirely different light. It seems that during the whole of the action of May 1, when Cavite was bombarded by the American squadron, the staff of the cable company, from the superintendent downward, were at their posts, although their office is situated only 200 yards from a Spanish battery, which several times opened on the American ships. Fortunately, however, the latter did not reply. Having completed the destruction of the Spanish fleet and Cavite arsenal, Commodore Dewey lined his ships up in front of Manila, with their guns trained on every shore battery, with the evident intention of commencing a bombardment should a single shot be fired on his squadron from any of the batteries. The operators of the cable company were all this time in their office, transmitting the telegrams which were handed to them, as if nothing unusual was happening. On the evening of May 2 the Hong Kong cable became interrupted. Two of the operators of the company immediately proceeded to the cable house on the beach, which is within a stone's throw of a battery, then threatened by the American guns, and having set up a testing apparatus, found that the cable was broken about ten miles from shore. From that time to the fall of Manila the telegraphers stood by their office day and night, although the building was repeatedly struck and pierced by bullets from the insurgent forces, who maintained a determined attack on the Spanish intrenchments in the neighborhood. Although they were given by the directors permission to retire to a place of safety, they never left their posts.

In Cape Colony, South Africa, the Government controls the colonial telephones. In April, 1898, there were 1,535 instruments in use, and the revenue for 1897 amounted to $66,137.22. There are 869 miles of wire and 780 subscribers. Seven exchanges in the colony work on the single-wire system, but arrangements are now being made to have all lines duplicated, and in future no exchange will be established except on the metallic circuit system. In the course of the next few months the underground cable system in Cape Town will be completed and exchanges established in the suburbs.

The Des Moines, Ia., *Register* of August 20 states that a large party of workmen have been at work several days for the Iowa Telephone Company, placing another circuit between Des Moines and Indianola. The new circuit will complete the metallic circuit between Des Moines and Oskaloosa and the towns in the eastern part of the State, reaching as far as Davenport. The company expects that its service will be greatly improved over the State by the new connection.

A new telephone company is being organized at Amherst, Mass. A sufficient number of subscribers have been obtained for the instruments of the new company to make its success sure.

New Companies Incorporated.

The Newton Telephone Company, Newton, Kan.—to build a long distance telephone line from Newton to Moundridge. Manager, A. R. Champlin.

The Montezuma Telephone Company, Montezuma, Ga.—to construct a telephone exchange. Capital stock, $1,000. Incorporators: Jule Felton and Mrs. C. H. Maxwell.

The Winchester & Lexington Telephone Company, Vine Grove, Ky. Capital stock, $1,560. Incorporators: T. C. Vanmeter, David Prewitt and S. D. Goff.

The Siloam Springs Telephone Company, Siloam Springs, Ill. Capital stock, $1,500, fully paid. Incorporators: G. L. Thompson, John Padgett, John W. Buttz, George Wauer, John B. Wallace, B. A. Curry and W. H. Breckenridge.

The following companies have been incorporated in West Virginia:

New Rochelle Telephone Company, New Rochelle, N.Y. Capital stock authorized, $500,000; subscribed, $100; paid in, $100.

Twelvepole Valley Telephone Company, Wayne, W. Va. Capital stock authorized, $25,000; subscribed, $50; paid in, $50.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Aug 29						
Albany Ry. Co.	100	2,000,000	$1,750,000	1½ % Q., Feb. '98.	146⅛	150
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	69	70
Traction Co. (Saratoga)	100	50,000	50,000	....	..	..
Allentown, Pa.—Aug 29:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Aug. 29:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	85	..
Baltimore, Md.—Aug 29:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	..	72½
aBaltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23⅛	23½
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—Aug 29:						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	...	..
North Shore Traction Co........com.	100	4,000,000	4,000,000	....	11	13
North Shore Traction Co........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	79	80
b West End Street Ry. Co........com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	87	87¼
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	...	105½
Boston Elevated R. R.	100	10,000,000			69	69½
Brooklyn N. Y.—Aug 29:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	63⅞	64
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	214	216
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	190	..
Kings County Elevated	....	4,750,000	4,750,000	....	4	6
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	..	...
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Aug 29:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	....	55	60
*Buffalo Railway Co.	100	6,000,000	5,370,500	1 % Q. Dec., '97.	80	81
Columbus O.—Aug 29:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb., '98.	50	51
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Aug 29:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co.	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Aug 29:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	285	295
Chicago & South Side R. T. RR.	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR.	100	10,000,000	10,000,000	....	12¾	13
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	....	..	2¾
Met. West Side El. const. stk.	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Jan., 98.	225	226
hNorth Chicago City RR.	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co.	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	94½	95
jChicago West Div. Ry.......guar	....	1,250,000	621,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Aug 29:						
Cincinnati Inc. Plane Ry........com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co.	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	114¼	114½
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Aug 29:						
Akron, Bed. & Clev. Elec. Ry.	100	1,000,000	1,000,000	¾ % Jan., '98	37	39
Cleveland City Ry.	100	8,000,000	7,600,000	¾ %., Oct., '97.	..	..
Cleveland Electric Ry.	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	60	61
Detroit, Mich.—Aug 29:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co.	....	250,000	250,000	....	..	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry.	100	250,000	200,000	....	100	110
Dayton O.—Aug 29:						
City Railway Co..............com.	100	1,500,000	1,470,600	1¼ % Q., Jan.1,'98.	100	102
City Railway Co..............pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	150	155
People's Street Railway	....	1,100,000	....	....	100	..

* Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $525,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Aug 29:						
Hartford Street Ry. Co.	100	$4,000,000	$200,000	3 % S., Jan., '98.	140	—
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	—
Holyoke Mass.—Aug 29:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—Aug 29:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70	—
Indianapolis, Ind—Aug 29:						
**Citizens' Passenger Ry.	....	5,000,000	5,000,000	....	27	30
Lancaster, Pa.—Aug 29:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000	....	..	—
Lancaster & Col. Electric Ry.	....	....	87,500	....	..	—
West End Street Railway	....	....	....	....	..	—
Louisville, Ky.—Aug 29:						
Louisville Ry.....................com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	35	39
Louisville Ry...............5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	98	100
Minneapolis, Minn.—Aug 29:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	18	23
Twin City Rapid Transit....7 % pfd.	....	8,000,000	1,714,200	1¾ %. Jan., '98.	..	100
Montreal, Canada.—Aug 29:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	276¼	276¾
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1¼ % S., J. & J.	100	100⅞
Memphis, Tenn.—Aug 29:						
Memphis Street Railway Co.	100	500,000	500,000	....	15	—
New Haven, Conn.—Aug 29:						
Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co.	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	..
Winchester Avenue RR.	25	1,000,000	600,000	....	40	42
New Orleans, La.—Aug 29:						
Canal & Claiborne RR. Co.	40	240,000	240,000	4 % S., Jan., '98.	146	170
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co.......com.	100	5,000,000	5,000,000	....	1	2
New Orleans Traction Co........pfd.	100	2,500,000	2,500,000	....	6½	8¼
aCrescent City RR.............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	32
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	85	88
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	18	22
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	53	54½
New York—Aug 29:						
Central Crosstown RR.	100	600,000	600,000	2½ % Q., July, '97.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Jan., '98.	150	160
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98.	170	175
dMetropolitan Street Ry. Co.	100	30,000,000	30,000,000	1¼ % Q., Jan., 98.	163	164
eBleecker St. & Fulton Fy.Ry.guar	100	900,000	900,000	¾ % A., July, '97.	32	34
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	212	220
gCen.Park,N.&E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98.	180	190
hEighth Avenue RR.	100	1,000,000	1,000,000	....	320	..
i42d St. & Grand St. Ferry RR.guar	100	750,000	748,000	4½ % Q., Feb., '98.	340	360
jNinth Avenue RR........guar.	100	800,000	800,000	....	170	180
kSixth Avenue RR.............guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q. Feb., '98.	330	..
Second Avenue RR.	100	2,500,000	1,862,000	2 % Q., Jan., '98.	178	181
Third Avenue RR.	100	12,000,000	10,000,000	2 % Q., Feb., '98.	175	180
m42d St.,Manhatv'le & St.Nich.Av	100	2,500,000	2,500,000	....	59	..
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Aug 29:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	51½	52
Newark Passenger Ry.	100	6,000,000	6,000,000	....	..	.
nRapid Transit Street Ry.	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Aug 29:						
Allegheny Traction Co.	50	500,000	500,000	....	...	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	17¾	18
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	55½	56⅝
pCentral Traction Co.	50	1,500,000	‖900,000	....	...	...
qCitizens' Traction Co.	50	3,000,000	‡3,000,000	6 % A.	63	...
rDuquesne Traction Co.	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co.	50	2,500,000	1,900,000	3 %, Aug., '95.	..	...
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,100,000	2½ %, Jan., '98.	..	...
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	‖2,991,889	2 %, Aug., '95.	..	...
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	2¾	...
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 97	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co.	50	800,000	200,000	....	..	.

* Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Aug 29						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	158
Northampton, Mass—Aug 29						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	168	175
Omaha, Neb.—Aug 29:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Aug 29:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	85	86
Providence, R. I.—Aug 29.						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	70	72
Philadelphia.—Aug 29:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	43½	45
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‖533,900	3 % S—July, '98.	65¾	66
aFairmount Pk. & Had. Pass. Ry.	50	800,000	300,000	3 % Feb. 1, '98.	65	66
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450		20¼	20½
cElectric Traction Co	50	....	8,297,920		71½	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	390	..
fLehigh Avenue Ry. Co	50	1,000,000			47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A. Mar. 98	256	..
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135⅛	..
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000		...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402		...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	91¼	95
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
iContinental Pass. Ry.....guar..	50	1,000,000	‖580,000	$6 share—July, '98.	142½	..
Empire Passenger Ry. Co	50	600,000	‖600,000		...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	175	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90¼	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	288	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	275	...
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.—Aug 29:						
Rochester Railway Co	100	5,000,000	5,000,000	....	9	12
Reading, Pa.—Aug 29:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	..
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	64	..
St. Louis Mo.—Aug 29:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % July, '98.	126	128
National Railway Co	..	2,500,000	2,479,000	1½ %, July, '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 % Oct., '93.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry.......com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	110	112
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	58	55
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Aug.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	107	108
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅜	53¾
Presidio & Ferries RR	100	1,000,000	550,000	....		8½
Scranton, Pa—Aug 29:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
mScranton & Carbondale Trac. Co..	100	500,000	500,000	....	..	18
mScranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Aug 29:						
Springfield Consolidated Ry	100	750,000	750,000	....	....	11
Springfield O.—Aug 29:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—Aug 29:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—Aug 29:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	100	100⅞
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	276¼	276¾
Washington, D. C.—Aug 29.						
Belt Ry. Co	50	500,000	500,000			
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	73⅛	75
Columbia Ry. Co	50	400,000	400,000	6 % A.	76½	78
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	121	123
Worcester, Mass.—Aug 29:						
*Worcester Traction Co........com.	100	8,000,000	8,000,000	....	15	17
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	8 % S., Feb., '98.	93	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Aug 29:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
ij Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 29:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., July, '98.	283	284
Erie Telegraph & Telephone Co	100	......		1 ¾ Q., Jan. '98.	73	74
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Feb. '98.	144	..
New York.—Aug 29:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	96	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	106	108
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	180	185
Franklin Teleg. Co.......2½ % guar.	100	1,000,000	......	1¼ % S.	40	..
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan., '98.	71	72
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	118
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	107	110
Mexican Telephone Co	100	2,000,000	......		.59⅛	.75
*New York & New Jersey Tel. Co..	100	5,000,000	8,723,000	1½ % Q., Jan., '98.	149½	150½
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000		2 % S.	70	75
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	113
Western Union Telegraph Co	..	......	97,870,000	1¼ %, Jan., '98.	91½	94½
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Aug 29:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	169½	174
Chesapeake & Potomac Telep. Co..	100	......	......	....	45	..
Chicago Telephone Co	100	......	......	....	202	..
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	..	..
Empire & Bay States Telegraph Co.	...	......	......	....	68	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	76	78
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	110	115
Providence (R. I.) Teleph. Co	50	....	......	....	85	86½
Southern New Eng. Teleph. Co	100	8,000,000	......	....	119	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Aug 29:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
General Electric Co...........com.	100	40,000,000	30,460,000	2 % Q., Aug., 1893.	40½	40¾
General Electric Co..........pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	97	99
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	8
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	30½	32
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., July, '98.	57½	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Aug 29:						
Edison Elec. Ill'g Co., New York..	100	9,138,000	7,988,000	....	132	134
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	4,000,000	1½ % Oct., '97.	122	123½
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	21	23
General Electric Co...........com.	100	40,000,000	30,460,000	2 % Q., Aug, 1893.	40½	40¾
General Electric Co...........pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	97	99
Interior Conduit & Insulation Co...	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co....pfd	..	......	......	....	..	..
Pittsburg, Pa.—Aug 29:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	130	140
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Aug 29:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	84¼	85
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	41¼	42
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co..	10	6,500,000	550,000	$32500 dis. Jan.11'97	13½	14
Southern Elec. Light & Power Co..	10	187,500	187,500	....	8	10
Miscellaneous.—Aug 29:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	32	87
Missouri-Edison (St. Louis)....com.	..	......	......	....	12	14
Eddy Electric Mfg. Co	25	......	......	....	....	13
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	115	125
Hartford (Conn.) Lt. & Power Co..	25	175,000	......	....	4	7
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	170	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	83½	87
Rhode Island Elec. Protec. Co	100	......	......	....	110	120
Royal Elec. Co. (Montreal)	..	1,000,000	......	2% Q	*161½	163
Toronto (Canada) Elec. Light Co...	100	1,085,000	1,085,000	1¾ % Q	136¾	137
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	100	110

*ex d.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Aug 29:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	35	87
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—Aug 29:						
Consolidated Electric Storage Co...	...	......	....	....	18	20
Edison European	..	......	....	....	1	8
Safety Car Heating & Lighting Co..	100	......	....	......	98	102
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	21	28
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	90	98
Philadelphia, Pa.—Aug 29:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1	1½
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	18	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	75	..
Welsbach Light Co	5	525,100	......	....	52	54
Welsbach Light Co., Canada.	5	500,000	......	....	1½	1¾
Pittsburg, Pa.—Aug 29:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q	112	115
Miscellaneous.—Aug 29:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	13	16
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	...	55
Billings & Spencer Co	25	......	....	....	30	37
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	80	85
Johns-Pratt Co	100	......	....	....	..	97
*Pratt & Whitney Co..........com.	100	......	....	....	4	8
*Pratt & Whitney Co...........pfd	100	......	....	....	40	50
Stillwell-Bierce Co............com.	..	......	....	....	70	80
Stillwell-Bierce Co............pfd.	..	......	....	2 % Sept. 1, '97.	106	109
Shultz Belting Co	100	500,000	....	....	60	80
St. Charles Car Co	..	....	....	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Aug 29, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry……1st mtg. 5s.	….	$29,000	1905	….	….	….
The Albany Ry. Co……Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	….
‡The Albany Ry. Co……Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	….
‖Watervleit Turnpike & RR.1st mtg. 6s	350,000	350,000	1919	M. & N.	*118½	….
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	….
Troy City Railway Co……1st 5s	….	….	……	……	*105	105½

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Aug 29, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry…1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113½	114
Baltimore Traction Co……1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	113½	114
Baltimore Trac. Co..Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	103⅛	104
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116¼
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	………	1900	J. & J.	102¼	102¾
†Baltimore Traction Co. Convertible 5s.	800,000	………	1906	N. & M.	103½	……
Central Pass. Ry. Co……1st mtg. 6s.	96,000	117,000	1912	J. & J.	…..	….
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	116	117
City & Suburban Ry……1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	114	……
Lake Roland Elev.……1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	….
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	118	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st.mtg.bds.

Boston, Mass.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR……1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	105
West End Street Ry……Deben. g. 5s.	8,000,000	3,000,000	1902	M.& N.	104	105
West End Street Ry……Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	….

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR……1st mtg. 5s.	500,000	47,000	1906	J. & J.	…	….
†Charleston City Ry……1st mtg. 6s.	850,000	….	….	J. & J.	….	….

†Controlled by Charleston St. Ry .Co.

Chicago Ill.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry……1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¼	102¼
‡Chicago Passenger Ry……1st mtg. 6s.	400,000	400,000	1903	F. & A.	….	102
‡Chicago Passenger Ry…Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	……	….
¶Chicago & So. Side R. T…1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	….	….
Chicago & So. Side R. T……4½s.	1,500,000	750,000	1907	J. & J.	….	……
‖Chicago West Div. Ry……1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	103⅛	……
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	….	……
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	54	54¾
North Chicago St. RR……1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105
North Chicago St. RR….Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	….	103
North Chicago City Ry……1st mtg. 6s.	500,000	500,000	1900	J. & J.	….	….
North Chicago City Ry……consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	104	104¼
West Chicago St. RR……1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	104½	….
West Chicago St. RR……Deben. 6s…	2,700,000	700,000	1911	J. & D.	99¼	99⅞
West Chicago St. RR….Con. mtg. g. 5s.	12,500,000	6,000,000	1936	……	……	94
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	……	….

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Aug 29, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov.St. Ry.1st Con.mtg. g.5s	3,000,000	2,500,000	1922	J. & J.	102	102½
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	108
†Mt. Adams & Eden P'k In…1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	….
†Mt. Adams & Eden P'k Inc. Cons. mtg.5s	531,000	531,000	1906	M. & S.	107¼	108½
So. Cov. & Cin. St. Ry……1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	……
‡So. Cov. & Cin. St. Ry……2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

†Assumed by the Cincin. St. Ry. Co.
‡$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co……1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	102	102½
Cleveland City Cable Ry……1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	100	102
†Cleveland Electric Ry.Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	106
Columbus (O.) Cent. Ry…1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	……	……
aEast Cleveland RR……1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102	105
Ft. Wayne (Ind.) Elec. Ry.1st mtg. g. 6s.	600,000	………	1922	M. & N.	……	….
Lorain (O.) Street Ry……1st mtg. 6s.	200,000	200,000	1915	J. & J.	……	….
‡St. Ry. Co., Grand Rapids…1st mtg. 5s.	600,000	600,000	1912	J. & D.	….	….

†$1,900,000 in escrow to retire bonds of absorbed companies, marked a.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry……1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry…1st mtg. 6s.	400,000	377,000	1902	A. & O.	….	….
The Detroit Ry……1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	……	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry……1st mtg. 5s.	600,000	600,000	1918	M. & S.	106	……
New Haven (Edgewood Div.)1st mtg.5s.	250,000	250,000	1914	J. & D.	104	….
Winchester Avenue RR…1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	….
Winchester Avenue RR…Deben. g. 5	100,000	94,000	1908	M. & S.	102	….

*With interest. *Unlisted.

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR……1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	101	….
Crescent City RR……1st mtg. 6s.	……	50,000	1899	M. & N.	100¼	……
Crescent City RR……Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	76	79
New Orleans City RR……1st mtg. 6s.	416,500	399,000	1903	J. & D.	105	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	100¾	101¼
N. Orleans & Carrollton RR.2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	110	….
Orleans Railroad Co……Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	101½	….
‡St. Charles St. RR. Co……1st. mtg. 6s.	300,000	75,000	1906	J. & D.	104¼	….

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)….Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	….
Atlantic Av. (Brooklyn).1st gen. mtg.5s.	759,000	759,000	1909	M. & S.	107	……
†Atlantic Av. (Brooklyn)..Cons. mtg. g. 5s.	3,000,000	1,966,000	1931	A. & O.	108	……
‡Bro'dway & 7th Ave.1st cons. mtg. g. 5s	12,500,000	7,650,000	1943	J. & D.	119	120
Broadway & 7th Ave……1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave……2d mtg. 5s.	500,000	500,000	1914	J. & J.	110	112
Broadway Surface……1st mtg. 5s.	1,125,000	1,125,000	1924	……	115	117
Broadway Surface……2d mtg. 5s.	1,000,000	1,000,000	1905	……	104	105½
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	112	114
¶Brooklyn,Bath & W.E. RR.Gen.mtg.5s.	1,000,000	448,000	1933	J. & J.	90	….
Brooklyn Heights RR……1st. mtg.5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	……	80
Brooklyn Rapid Transit……gold 5s	7,000,000	5,181,000	1945	………	105¾	……
Bleecker St.& Fult'n Fer'y RR.1st mtg.7s	700,000	700,000	1900	……	101	104
Cent P'k, N. & E. R. RR.1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	110	111
Central Crosstown RR……1st mtg. 6s.	250,000	250,000	1922	M. & N.	118½	……
Coney Island & Brooklyn RR.1st mtg.5s	300,000	300,000	1903	J. & J.	103½	104
§D. Dock,E. Bd'y & Bat'y R.gen.mtg.g.5s	1,000,000	930,000	1932	J. & D.	116	118
Dry Dock, E. Bd'y & Bat'y RR..scrip 5%.	1,100,000	1,100,000	1914	F. & A.	101	*102
Eighth Av. RR. Co……Cert. indebt. 6%.	1,000,000	1,000,000	1914	F. & A.	108	……
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	113	116
42d St., Man. & St. N. Av..2d mtg. inc. 6s	1,500,000	1,500,000	1915	J. & J.	90	95
Lex. Ave. & Pav. Ferry RR.1st mtg.g.5s.	5,000,000	5,000,000	1993	M. & S.	121	122
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	113	….
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	107	109
Second Avenue Ry……Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.)……1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co……1st mtg. 5s.	350,000	350,000	1919	……	113½	114
Third Avenue RR……1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124	125
Twenty-third Street Ry……1st mtg. 6s.	………	………	1909	J. & J.	……	….
Twenty-third Street Ry……Deb. 5s	150,000	150,000	1906	J. & J.	103	….
Union (Huckleberry) Ry……1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	114½
‡‡Westchester Electric RR…1st mtg. 5s.	500,000	500,000	1943	J. & J.	109	….

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry……1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	….	….
†Toronto St. Ry……1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	….	….

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—Aug 29, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry……1st. mtg. 6s	850,000	310,000	1909	J. & J.	….	….
Empire Pass. Ry……1st mtg. 7s	300,000	200,000	1900	J. & J.	….	….
Greene & Coates St. Ry……1st mtg. 6s	100,000	100,000	1898	J. & J.	….	….
Lombard & So. St. Pass. Ry…1st mtg. 6s	150,000	………	1901	……	….	….
People's Pass. Ry……1st mtg. 7s	250,000	250,000	1905	J. & J.	….	….
People's Pass. Ry……2d mtg. 5s	500,000	458,000	1911	J. & J.	….	….
People's Pass. Ry……Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	….	….
People's Pass. Ry……Stk. trs. cert. g. 4s	5,698,210	……	1943	……	102	103
Phila. City Passenger Ry……1st mtg. 5s	200,000	200,000	1910	J & J.	……	….
Philadelphia Trac. Co……Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry……1st mtg. 7s	100,000	100,000	1903	A. & O	….	….
Union Passenger Ry……1st mtg. 5s.	500,000	500,000	1911	A. & O.	….	….
§Union Traction Co……Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	….	……
West End Passenger Ry……1st mtg. 7s.	………	……	1905	……	….	….
West Phila. Pass. Ry……1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	….
West. Phila. Pass. Ry……2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown……6s.	500,000	500,060	1931	M. & S.	90	……
Central Traction Co……1st mtg. 5s.	375,000	375,000	1930	J. & J	……	….
Citizens' Traction Co……1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	……	118
*Duquesne Traction Co……1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108½	….
*Fed'l St. & Pleas. Val. Jack's Run……5s.	50,000	50,000	1913	J. & J.	……	……
Fed'l St. & Pleasant Valley……Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	……	….
Millvale, Etna & Sharpsburg……5s.	750,000	750,000	1923	M. & N.	105½	……
Pittsburg, Crafton & Mansfield……5s.	250,000	250,000	1924	J. & J.	……	….
Pittsburg Traction Co……1st mtg. 5s.	750,000	750,000	1927	A. & O.	……	….
Pittsburg & Birmingham……1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	….	105¼
Pittsburg & West End……1st mtg. 5s.	500,000	500,000	1922	J. & J.	….	….
*Pg'h., Allegh. & Manch……Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	….	……
Second Ave. Traction Co……5s.	2,500,000	2,000,000	1934	J. & D.	….	….
Sub. Rapid Transit Railway Co……6s.	500,000	500,000	1918	M. & S.	……	….

Providence R. I.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry……Coupon 5s	50,000	50,000	1910	J. & D.	……	……
United Trac. & Elec. Co……1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation—Aug 29, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR……1st mtg. 5s.	250,000	250,000	1913	J. & J.	100½	101½
Cass Ave. & Fair Gds. Ry……1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	101½	102½
Citizens' Railway Co……1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter…1st 6s	1,000,000	1,000,000	1913	J. & J.	111	112½

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Aug 29, 1898.						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	$50,000	$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co....................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	106⅝	107½
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	107	108
†Mound City RR. Co.............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	103
People's RR. Co....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co...................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. 5s.	2,000,000	1,400,000	1921	F. & A.	101¼	102⅝
St. Louis & Sub. Ry..............Income 5s.	300,000	300,000	.....	....	60	65
††Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry......1st mtg. 6s.	500,000	500,000	1913	J. & J.	110½	111½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,737,000	1918	J. & J.	114½	115½
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation— Aug, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	114¼	....
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	113½	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	92½	97½
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	126	....
†Metropolitan Ry. Co................1st mtg.	200,000	....	.....	....	.....	.....
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	124½	......
†Park & Cliff House RR........1st mtg. 6s.	350,000	350,000	1912	J. & J.	109	......
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	88½	110
†Powell St. Ry.......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118½	120
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	109¼	110
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Aug 29, 1898.						
Belt Ry. Co.......................Cons mtg 5s.	500,000	450,000	1920	J. & J.	33	....
Columbia Ry..............................1st mtg. 6s.	500,000	500,000	1914	A. & O.	118	122
Eckington & Soldiers' Home..1st mtg. 6s.	200,000	200,000	1911	J. & D.	85	100
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	118	119½
†$50,000 in escrow to retire 1st mtg.bds.						
Miscellaneous.						
Date of Quotation—Aug 29, 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	113	115
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‖Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	110½	111½
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	101	102
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	107	107¼
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	10½
Denver City Cable Ry..........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	79
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	113	114
§Minneapolis St. Ry..1st cons. mtg. g. 5s.	5,000,000	4,050,000	1919	J. & J.	90	93
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	3,000,000	2,378,000	1928	J. & J.	102	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	96½	98½
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$700,000 in escrow to retire bonds of O. C. St. RR. Co.						
‖$87,000 in treasury.						
§$950,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Aug 29, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	107	....
Pittsburg, Pa.						
Date of Quotation—Aug 29, 1898						
Allegheny County Light Co..............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1913	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	......	......
Miscellaneous.—(Aug 29, 1898.)						
Edison El. Ilg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	110	....
Edison El. Ilg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117½	......
Edison Elec. Ilg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	......	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	......	....	....	......
Edison Ilg. Co. (St. Louis)..............	4,000,000	....	1928	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)..1st mtg. 6s.	500,000	....	1909	A. & O.	....	......
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	....	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	....	....	....	....	......

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Aug 29, 1898.						
American Bell Telephone...................7s.			1898	F. & A.	101½	....
Northwestern Telegraph Co................7s.	....	......	.....	......	......	....
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	....	......	....	....	106	....
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Aug 29, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Farmington & Sims Eng. Co..................	....	......	....	......	......	25
Barney & Smith Car Co..........................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co............................6s.	....	......	1904	M. & S.	....	....
Worthington Pump Co............................	75,000				....	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12@12⅛c.; Lake, 12.15@12.25c.; casting, 11⅞@12c.

A meeting of the stockholders of the Bell Telephone Company of Philadelphia will be held on September 20 to vote on increasing the capital stock from $2,000,000 to $4,000,000.

The interest upon the scrip of the Westinghouse Electric & Manufacturing Company to September 1, 1898, will be paid to holders of record of that date. Books closed August 24 and reopen September 2.

The stockholders of the Postal Telegraph Company will hold a special meeting in New York on September 8 to vote upon the proposition to reduce the capital stock of the company from $15,000,000 to $10,000,000.

The Coney Island & Brooklyn Railroad Company reports for the quarter ended June 30: Gross earnings, $274,753; net earnings, $145,969; other income, $29,142; charges, $156,261; surplus, $18,850, against $17,207 in 1897.

The Bloomington & Normal Street Railway, as successor to the Bloomington City Railway, has made a mortgage to the Illinois Trust & Savings Bank of Chicago, as trustee, to secure an issue of $250,000 first mortgage 5 per cent. bonds.

The stockholders of the American Telephone & Telegraph Company, the company controlled by the American Bell Telephone Company and owning that company's long-distance telephone system, will vote September 8 upon a proposition to increase the capital stock from $20,000,000 to $25,000,000.

The first mortgage bondholders' committee of the Terre Haute (Ind.) Street Railway Company has prepared a bondholders' agreement and has secured the deposit of more than a majority of the bonds thereunder. The limit of time for receiving deposits at the Illinois Trust & Savings Bank, Chicago, has been fixed at September 15.

The sale of the Suburban Traction Company of Orange, N. J., was completed on the 24th inst., on which day the purchasers of the road completed the payments, fulfilled all the conditions of the sale and were given full possession. Receiver Whittlesey represented the Suburban Company and Charles A. Sterling, Bernard M. Shanley and John Ely the purchasing company.

The Chicago "Dispatch" says that "of the $2,000,000 of Commonwealth Electric Company bonds recently issued it is announced that $500,000 have been placed in London with the London-Scottish American Trust through Aldis, Northcote & Wilson. In addition $1,000,000 have been placed in Chicago. N. W. Harris & Co. are offering the remaining $500,000 of the bonds to the public."

A notice calling in its issue of 5 per cent. bonds has been sent out by the Newark (N. J.) & South Orange Railway Company. The issue aggregates the sum of $500,000, and the call is the result of an arrangement with the North Jersey Street Railway Company, whereby the latter absorbed the Newark & South Orange Company. Now 4 per cent. bonds will soon be floated by the company, it is said.

The New York State Railroad Commission has authorized an increase of the capital stock of the Catskill Electric Railroad Company from $30,000 to $400,000. The road was originally built to be operated for a distance of only about two miles from Catskill village, but it now plans to extend its scope by running out to Windham and Cairo and other villages in Greene and adjoining counties, making a line 16 miles in length.

The General Electric Company of Schenectady has filed with the Secretary of State at Albany a certificate of reduction of capital stock as follows: Common stock, from $30,460,000 to $18,276,000, and preferred from $4,252,000 to $2,551,200, making the total capitalization of the company $20,827,200, or a reduction of $13,884,800. The amount of capital actually paid in to the corporation was $34,712,000, and the amount of debts and liabilities is estimated at $6,269,800.

The United Electric Securities Company, Boston, invites proposals for sale to it of so many of its collateral trust 5s, bonds of the fifth, seventh, ninth and tenth series, as can be purchased with the following amounts of cash: Fifth series, $9,778.91; seventh series, $3,893.75; ninth series, $47,553.75; tenth, $12,800; total, $74,026.41. Sealed proposals will be received at the office of the company in Boston until 12 o'clock M. August 31. All bonds accepted will be paid for September 2 on delivery, together with accrued interest to that date.

The St. Louis "Republic" states that St. Louis capitalists are at work on a scheme, which if successful will place them in possession of the rights and franchises to operate all the street railroads in Havana as soon as the terms of peace are sufficiently defined to enable them to proceed. It is the intention to put in a system of trolley roads in Havana that will completely cover the city. Not only is it the intention of these parties to operate a complete railroad system in the city of Havana, but also to extend lines out into the surrounding country, one in particular being projected to a fine bathing beach about 12 miles beyond the city limits.

Orders have been entered in the United States Court at Detroit for the sale of the Consolidated Street Railway Company of Saginaw to satisfy a claim of the Boston Safe Deposit & Trust Company, in trust, for $253,719, subject to receivers' certificates of $30,000. Also for the sale of the Union Street Railway Company of Saginaw to satisfy the claim of the Boston Safe Deposit & Trust Company for $361,149.75, subject to receivers' certificates of $59,000. The sale of the Consolidated Company may be made any time after August 16 and of the Union Company after November 26, and in both cases the bondholders or any party or parties at interest may be the purchaser. The court has dissolved the injunction issued at the instance of the city authorities April 20, 1897, for the forfeiture of the charter, holding that the charter had not been forfeited as against the bondholders.

The Chicago "Inter-Ocean" says: "By far the most novel use to which street cars in Chicago have yet been put is now being arranged by the Chicago General Railway Company on the Southwest Side. This road, famous for its ideas and its enterprising schemes, is planning to go into the draying and freight transferring business by trolley. If everything works as anticipated a few months from now will see curious flat-topped cars loaded with merchandise scurrying about on the Twenty-second street tracks. The idea was first suggested by the great number of steam railroads which the Chicago General Railway's tracks cross. In the thirty odd miles of line operated by the company no less than seventeen steam roads are intersected, and all in a factory and manufacturing neighborhood. The great amount of freight being hauled, transferred and shipped throughout the locality immediately showed the peculiar advantage which some means of cartage by electricity would possess over the present methods."

The stock of the Big Consolidated Railway, Cleveland, O., was raised several points last week through the efforts of the Andrews-Stanley and Everett-Moore factions to get possession of enough shares to control the election for directors in January next. The price of the stock at the beginning of the struggle was 60 and it reached 76¼ before the reaction came. The Cleveland "World" of the 25th says that interest in the contest had at that date died out completely and the market for the shares was as dull as it well could be. "There is reason to think," says the "World," "that one or the other of the warring groups of millionaires involved has secured the shares necessary to control, and that efforts will be made from time to time to unload shares on the excitable speculative public by the defeated faction, as long as the war scare can be worked." During the fight for control, according to the paper quoted, W. P. Todd of Chicago, formerly of Cleveland, asserts that he realized the handsome profit of $47,500 out of the sale of the stock.

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CONTENTS.

EDITORIAL NOTES.

The Outlook in the Electrical Industry.

Now that peace between this country and Spain is practically assured, it might be in place to consider what effect the changed conditions will have upon the electrical industry. During the past few months we have acquired either by conquest or annexation extensive territorial rights in various parts of the globe, which, judging from their present state of civilization, should shortly afford excellent opportunities to the enterprising electrical engineer and manufacturer. The islands which have come under the control of the United States as a result of the war are without exception lacking in up-to-date methods of manufacture and sorely in need of transportation facilities, as might readily be expected of former colonial possessions of such a conservative and hide-bound country as Spain. Cuba, the largest and most important of the islands, boasts of a few electric lights in its principal city which from all accounts are in need of modern apparatus to make them satisfactory. There are telegraph lines it is true, but no organized telephone system, and electrically propelled street cars are conspicuous by their absence. For an island with an area of 41,655 square miles, or in other words, about the size of the State of Pennsylvania, and with a population of almost two millions of people, this is certainly not a very excellent showing. The amount of electrical apparatus which this country exported to Cuba during the fiscal year which ended just previous to the opening of the war amounted to but $30,375, which, although considerably more than was sent by this country to any of the other islands now under our control, is an insignificant amount as compared to similar exports even to such remote South American countries as Argentina, Brazil or Colombia.

Porto Rico, which has a population of over 800,000 and an area of 3,550 square miles, is fairly well off as far as telegraphic facilities are concerned, and is provided in certain localities with telephone systems and electric lights. Our exports of electrical machinery to this island for the fiscal year just previous to the war amounted to but $22,801, which, taking into account the difference in area and population, would seem to be a better showing than in the case of Cuba.

The Philippine Islands however, owing probably to their great distance, make the poorest showing of all, there having been but $3,054 worth of electrical apparatus sent there from this country during this same fiscal year. Now that a stable government is assured for all these islands, and with their undeveloped resources, there should be a wide field for electrical enterprise, not only in the telephone and street railway lines, but in various industrial and manufacturing lines as well. That new markets for electrical apparatus of American manufacture will be created cannot be doubted, as already several companies have been organized to build and operate street railways and lighting plants in both Cuba and Porto Rico as soon as their new governments are established.

This opening up of Cuba, Porto Rico, the Philippines and Hawaiian Islands to American enterprise should do much toward reviving the electrical industry in this country and lifting prices to a safe and remunerative point, which cannot be said to have prevailed of late. Likewise the restoration of peace should be the signal for the starting up of various enterprises in street railway and lighting lines which were held back awaiting a better money market and the termination of the war.

* * *

Electricity as a Dissipator of Fog.

The recent accident to La Bourgogne, principally due to fog, has brought out various suggestions from more or less eminent men as to a means of warning vessels when in close proximity to one another, or of some method other than the auricular signals now in vogue. Probably the most original suggestion that has yet been advanced is that of dispelling a fog by means of electrical discharges. Mr. Alexander McAdie in a recent contribution to the *North American Review* advocates some such method, and gives his reasons for so doing. At the outset he states that air at sea level at a temperature of 80 degrees Fahrenheit, half filled with moisture, has eleven grams of water vapor to each kilogram of air. If the temperature is lowered, say 15 degrees, through a change in the pressure, the air will become saturated with water vapor, or in other words, will have all it can hold. Mr. McAdie then goes on to say: "If the mixed air and vapor can be lifted about 4,000 feet, the rain engineer can ordinarily form a cloud or fog. Conversely, if he can increase the pressure and supply the requisite amount of heat, he can alter conditions so that no fog forms, or, if it has formed, cause it to disappear. Provided we can control the thermo-dynamic conditions, we can condense the invisible vapor of the air into visible cloud, and, on the other hand, change the visible fog into invisible vapor."

In Mr. McAdie's opinion this desired result might be accomplished by a method suggested by Prof. Oliver Lodge, the well-known English savant, some time ago in a lecture before the British Association at Montreal. At that meeting Prof. Lodge related some experiments which he had carried on with a view to discovering a method of dissipating dust fog, which frequently gathers in towns and cities. He stated that

he had found that a bell jar filled with magnesium smoke or with steam could readily be cleared by an electrical discharge. Experiments were also carried on in a room filled with thick turpentine smoke, it being definitely shown that the air could be speedily cleansed of its solid particles by discharges of electricity at a high potential. In 1887 Prof. Lodge, while en route to this country, was detained for several hours by a very thick fog, regarding which he subsequently wrote as follows:

"Fog is an unmitigated nuisance. Electric light is powerless to penetrate it, and as we lay there idle it was impossible not to be struck with the advisability of dissipating it. It is rash to predict what can be done. It is still rasher to predict what cannot be done. I would merely point out that on board a steamer are donkey engines and that these can drive a very powerful Holtz or Wimshurst machine, one pole of which may be led to points on the masts. When electricity is discharged into fog on a small scale the fog coagulates into globules and falls as rain. Perhaps it will on a large scale, too."

Mr. McAdie thinks that the time has now come to try Prof. Lodge's suggestion, made over ten years ago, and points out as one of his reasons that all steamships and even ferry boats of any size are now equipped with dynamos which could readily be made to generate economically high potential currents of from forty to fifty thousand volts by the use of suitable transformers in series. He is of the opinion that "within a reasonable distance such discharges would certainly dissipate the fog and clarify the air." On the other hand, he admits that fog might be so dense as not to be affected by such electrical discharges, but thinks such cases would be exceptional. There would seem, in our opinion, no reason why such an experiment on a large scale should not be tried, as it could be done at comparatively little expense; whether it would prove successful, however, is debatable. That a discharge of high potential electric currents from a ship will dissipate a heavy fog at any considerable distance from the vessel is scarcely to be expected, and unless the area cleared were of at least moderate size, thus allowing the lookout to see a considerable distance ahead and on either side, it would not render ocean travel materially safer than it is at present.

* * *

The Use of Roentgen Rays in Cuba.

In an editorial which appeared in our issue of July 6 we described at some length the excellent results obtained by means of the Roentgen ray in an Indian campaign as described by Surgeon-Major Beever of the English army in a lecture before the Royal United Service Institution. At that time the Roentgen ray apparatus had not been given a fair trial in Cuba in locating bullet wounds, and there were many who still advocated the use of the probe, looking upon the X-ray apparatus as altogether too complicated for practical use in field hospitals. That the Roentgen ray apparatus may be used speedily and effectively is now clearly proven by Dr. William M. Gray, the microscopist of the Medical Museum in Washington, who was detailed to the hospital ship Relief by that institution for surgical work, with special reference to the diagnoses of gunshot wounds by the Roentgen rays. In an interview with Dr. Gray, which was reported in a recent issue of the New York *Sun*, he is credited with the following statement: "One thing this war has taught is that the probe in all its forms has gone out of use. No more searching blindly in a man's body for the bullet; no more danger of blood poisoning from the introduction into the wound of instruments of search. The fluoroscope tells us instantly where the projectile has imbedded itself, and we have only to cut it out as if it were there before our eyes. The ingenious electric probe and all similar devices have seen their day. In all future battles experts in skiagraphy will be attached of necessity to the medical corps, and the work of the surgeons will be materially assisted by their precise indications. We took out bullets by the pint on board the Relief, and almost without exception they were located by the X-rays."

As to the time consumed in photographing the patients and in developing the X-ray plates, Dr. Gray stated that the whole operation consumed but a few minutes. It took ordinarily not over five seconds for a wound in the hand, thirty seconds for one in the foot. He further mentioned a case where a man was wounded in the right shoulder by a Mauser bullet which plowed its way on around the chest walls under the deep muscles and finally lodged in the arm, shattering the humerus. He said: "Here was an odd condition, a wound in the right shoulder but no bullet; the bone of the left arm broken but no wound. How long do you suppose it would have taken to find that bullet by probing? It did not take us one minute to find it with the X-rays."

That the Roentgen ray apparatus can be advantageously made use of to alleviate suffering during a campaign is not to be doubted notwithstanding arguments to the contrary. This fact would seem to be clearly proven by the statement of Surgeon-Major Beever of the English army regarding the use of the X-ray in India and by Dr. Gray's experience in Cuba, who says: "In many cases we save hours of vain searching, and not infrequently we save the soldier's life."

Under the Searchlight.

Notes and Comments on Various Topics

ACCORDING to a statement in the N. Y. *Commercial*, credited to "a member of one of the large electrical organizations," "Eugene Griffin, vice-president of the General Electric Company, is at present in Porto Rico with the First Regiment of Engineers, of which he is colonel, and it is understood that he will study the country thoroughly in the interest of the company of which he is an officer. Upon his report will depend to a great extent the plans of the General Electric Company regarding the invasion of Cuba by their agents." This is placing Col. Griffin in a rather unpleasant light, and probably a false one, but if it is true and he carries a copy of the Bible with him, he would be doing his conscience a favor by reading a passage in the 6th chapter of Matthew, 24th verse.

* * *

PRESIDENT M. K. BOWEN of the Chicago City Railway Company discovered that the fender ordinance introduced in the city council provided that every car operated by a street railway company must have a fender, and being in a jocular mood he at once wrote a letter to Mayor Harrison in which he said that "the company which he represents does not want to do anything illegal, but its officials do not see how they can put fenders either on trailers or horse cars." A copy of the letter was sent to Acting Mayor McGann, who took every word seriously, and said the council would be asked to amend the ordinance at its next meeting.

* * *

THE following letter is word for word as the London *Electrical Review* received it, the name and address only of the writer being withheld: "Dear Sir,—Would you kindly give me the following information, I am desirous of entering the Electrical Engineering Proffesion either as Central Station or Consulting, I have a fair knolage of the Theory, but desire a Good Practical Training, could you recommend any College for this Purpose, if not an apprenticeship at a Works for a small Preinem. I am 21 years of age, but have a decided interest in the Work, I have no knolage of Mathematics at Present but would start at once, if you would advise me to procede. I am not at present in an Engineering Trade. Would you advise me to procede. I am Willing to give 3 to 5 years in the attempt. Thanking You in Anticipation I remainn Your in Earnest, —— ——."

* * *

THE following appeared in *Pearson's Weekly*:

Wild Man of Borneo—"I tell you the manager of this show is a smart chap."

Bearded Lady—"In what way?"

Wild Man—"For cases of emergency. While you were out this afternoon, the current from the Electric Girl struck the Man with the Iron Jaw, who was seated next to her, and nearly set the platform on fire, but the manager saved the show."

Bearded Lady—"What did he do?"

Wild Man—"He seized the India Rubber Man, shoved him in between the couple, and insulated the Iron Jaw Man."

* * *

THE Dustless Roadbed Company is the name of a Philadelphia concern which has been organized on a plan very different from that of the numerous incorporations that are springing into existence without any visible means of support. Its motto is "down with the dust." This unique concern, as we learn from the Philadelphia *Stockholder*, has just completed "oiling" eleven miles of the New York, Philadelphia & Norfolk Railroad at an expense of $75 a mile. One oiling is said to be sufficient to keep down the dust on a road for three years.

* * *

OTIS, ME., is said to have recently experienced the severest thunderstorm in its history. Some of the freaks of the lightning were remarkable. At the place of a man named Hanscom, two families occupied the house. In the front part an old man was seated in an armchair reading the Bible. A ball of fire rolled lazily in at the window, danced along the window ledge a second or two, and then rolled into the old man's lap and across the open Bible. He experienced no shock whatever, except a blinding sensation, but the metal clasps of the book were melted and ran to the floor, while across the pages of the book was stamped a miniature photograph of a large apple tree in the dooryard, near the window. Some minutes after the ball had passed the old man tried to rise, but was firmly held to his chair by some mysterious force. After an hour or more of effort by members of the household, a liberal bathing of vinegar and other remedies, the chair finally loosed its hold and he was able to rise. He felt no ill effects from his experience. The ball of fire, after dropping from the book, had struck the floor and bounded to the ceiling, passing out through the cracks in the top of the partition into the sleeping apartments of the Hanscoms, where young Mrs. Hanscom was seated with her baby in her arms. It came toward her a swaying ball, moving back and forth until it struck her full in the face and disappeared. Eight of Mrs. Hanscom's front teeth disappeared with it, and were never found. Her chair was tipped forward, and she was found unconscious, her head and feet resting on the floor, still retaining her position in the chair as if it were upright instead of resting upon her. It was some time before she could be revived. Strange to say, the baby was unharmed.

* * *

THERE are several styles of criticism or fault-finding to be met with in the columns of the modern newspaper. Some of them are spiteful, some peevish, some cynical, some impertinent, some that mash like a club, some that raise welts like a whiplash, and some that are as undefinable as the hues of a chameleon, among which may be classed the following, which we find in the Riverside (Cal.) *Enterprise*, under the heading "Our Electric Service":

A Washington official of wide experience recently said the heads of departments had just two kinds of men to deal with—men who went ahead and did the things they were expected to do, and men who always had the best of excuses for their continued failures. The fellows

who are running the electric power plant over at Redlands seem to belong in this latter category.

We think more and more of the electric light and the power that runs the rattling Mergenthaler and the big press every day. We have learned what an uncertain thing it is, and how dark the world seems when the deft and dainty-fingered monkey wrench manipulator over toward Smiley Heights opens the sea valves and allows the juice to escape in the direction of the Mojave desert.

As an electrician, we would probably be quoted below par. We don't know the difference between an armature and a ligature, and it is our impression that the volt was discovered by Voltaire, but we have a diseased imagination and a reputation for mendacity that entitles us, we believe, to consideration as an applicant for the place now occupied by the apologist-in-chief of the Redlands plant.

Light is a beautiful and holy thing, but it is becoming so scarce over in this neck of the woods that our contemporary, the *Press*, is thinking of adopting raised letters to enable its readers to absorb the contents after dark. Moreover, the sense of touch is being dangerously developed in our midst, several citizens having been touched within a week.

We trust that there will be an improvement soon in the service—not that we care to see any one killed, but it might be done without notifying us of the festival in advance.

Eugene F. Phillips' Clam Dinner.

This popular annual event, which is looked forward to by the electrical fraternity with as much delight as the coming of a circus affords to a village urchin, is announced to occur at the usual place, Pomham Club, Providence, R. I., on Saturday next, the 10th inst. The invitation cards are out. A right royal Rhode Island clambake is the leading gastronomic feature of these dinners, and adds unction to the speeches and other doings which combine to make the occasion so pleasant that every participant talks of it for weeks and then stores it away in his memory as a cherished experience. This being the twentieth annual recurrence of the festival, a company more numerous than usual may be expected, and consequently enhanced enjoyment; even the bivalves themselves, in view of its being the twentieth anniversary of their employment by the veteran manager of the American Electrical Works in contributing to the happiness of his trade friends, are likely to present themselves in their best form and condition. Lunch at 11:30; bake opens at 2.

Meeting of the American Street Railway Association.

As we go to press we are informed that the members of the American Street Railway Association have just convened in Boston. That the work of this Convention will be of the high order of that of other similar gatherings cannot be doubted. The proceedings of this their Seventeenth Annual Convention, and a full account of the excellent work that this able body of men is expected to accomplish, will be given in our next issue. The full programme of the meeting was given in last week's ELECTRICITY.

BOILER FEEDING BY INJECTORS.*

BY JAMES WHITCHER.

If with thoroughly open and impartial minds we start to argue out the problem of boiler feeding, we find ourselves led almost irresistibly to the conclusion that injectors should afford absolutely the best and most economical of the several methods available, so much so, that we begin to wonder why it is not the universal method, for its use entails no waste of heat, and its mechanism is of the simplest possible character, and of cheap, compact and durable construction.

Yet, in practical circles, we find that, apart from the strikingly unanimous confidence that is reposed in it for locomotive purposes, the method is viewed with deepest and general mistrust. One scarcely ever hears a good word for injectors applied to stationary boilers. Engine drivers and stokers as a class would have none of them if they could help it and where a pump and injector are fixed together to share the work the pump will be used, though in the last stage of ruin, while the injector is left to rust in idleness. When a reason is sought for this strong prejudice the answer is, that injectors cannot be relied upon, and that they use too much steam.

Now, it is evident at once that the former charge is an unjust one; for if injectors are not to be depended upon for general purposes, they would be equally unreliable for locomotives, and that is contrary to experience. Besides, plenty of instances can be adduced, particularly relating to low pressure boilers, where, in spite of the prejudice of attendants, single injectors (without a stand-by) have performed their duty in a thoroughly satisfactory manner for long periods, and required scarcely any attention or overhauling. It is, in fact, often the valves that give the greater part of the trouble that there is.

The second charge is of more importance, and it has undoubtedly a real foundation in fact, although the why and wherefore of it is a veritable puzzle, in view of the absolute absence of any avenue of escape for the energy that is apparently wasted in very liberal measure. Usually on the starting of an injector, the boiler pressure begins falling in a rapid, decisive manner, that means some anxious moments to the stoker, especially if he has the misfortune to be located in a district where smoke is under a strict taboo, and he has to be particularly canny with his dampers. The recovery is comparatively quick, but in the stoker's mind this does not go down to the credit of the injector. He ascribes it rather to the cessation of its baneful influence; and even when he does realize that this recovery is quicker than it would have been if the water had been pumped, there is not much comfort for him, for it is the fluctuation of pressure that concerns him most; and his grievance is that he cannot avoid it except by the short and frequent system of dosing his boiler, which he naturally abhors.

Probably the objectionable characteristic in the working of injectors is largely due to the use of a size too large for its average duty. The feed water is supplied at too rapid a rate for the furnaces, and this rate of influx is not visible as it is in the case of pumping and is not so easily regulated. The intangible mode of operation of injectors is necessarily a considerable obstacle in the way of confidence in their use, and a simple and effective indicator fitted to them, showing the rate of flow into the boiler, would be of much service. An injector so fitted, and constructed so that the rate of feed could be regulated over a long range, would be the equal of a pump in convenience of working. But for lack of these features the stoker has certainly a true bill against the injector, and good reason for his preference for a pump. The latter gives him a sensitive means of controlling the pressure, additional to mere manipulation of the furnace, whereas the injector practically deprives him of it—not, of course, that it is impossible to regulate the feed with some forms of injectors, but the requisite judgment and familiarity in using the apparatus is not so easily acquired.

There is good reason for the belief that injectors are big steam eaters, for under many conditions they must be delivering the feed nearly at boiling temperature and sufficient steam is consumed to effect this. Thus supposing a supply of feed water for half an hour's consumption is put into the boiler in the first five minutes. If pumped, the cool water lies low in the water space, and takes heat, mostly from the furnaces, and at a fairly constant rate throughout the whole period of 30 minutes. But if injected, the feed is not only delivered, but also heated nearly to steaming point, within the short period, and the extra duty is done, not direct by the furnace, but by the store of steam. Steam is made quicker during the subsequent 25 minutes, but the effect is a pronounced fluctuation of pressure, being a rapid fall followed by a slower rise; and the variations are too sharp to be modified easily by the mode of firing. The excessive draught on the store of steam produces almost as serious a fall of pressure as would result if the cool water from the pumps were to be sprayed into the steam space instead of delivered in a sluggish stream below the water level.

These fluctuations are not actually so very serious an objection to the injector, and they would be less significant if stokers would only educate themselves up to an intelligent use of the appliance. The chief trouble is that it forms so ready a handle for aspersions on the economy of injectors. Immature reasoning faculties find in the traveling back of the steam gauge, when the injector is turned on, triumphant proof of its wastefulness too conclusive to be confuted by any argument to the contrary; and it is useless generally, in the face of this conviction, to argue the impossibility of there being any real waste.

However, there are two counts on which indictments may be urged against injectors with a greater show of reason. These are that their use depreciates the efficiency and working capacity of the boiler, and the efficiency and capacity of the feed heating devices, if any. Now, as to the first, we have it on good authority that live steam feed heaters, far from diminishing the efficiency and capacity of boilers, increase them by upwards of 10 per cent. This surprising fact was indubitably established some time ago by the experiments of Kirkaldy and others; but it is not at all clear yet whether it applies equally to all kinds of boilers and to all conditions of working. If it does, it is no more possible to maintain that injectors, any more than feed heating devices of any kind, have a deleterious effect on the working activity of the boiler. Their influence, instead, should be quite the other way.

Were it not for the startling result of the above-mentioned investigations we should not have much hesitation in assuming that a cold feed would induce a more rapid transmission of heat than a hot feed, and therefore that the work proper obtained from the boiler is greater in the former case than in the latter. It tells us, however, that the reverse is the case; and the reason why is very obscure, no satisfactory explanation being possible with our present knowledge of the operation of heat transmission in a boiler. But the practical meaning of it all is that feed heating makes for economy, not only because of the net amount of heat added, but also because of the mere fact of its elevating the mean temperature of the boiler contents.

As to the second count we are on surer ground. For instance, it would certainly be a mistake to pass the feed water from an injector indiscriminately through an exhaust feed heater, for little heat could be gained, and some might be lost. As most injectors are unreliable if supplied with water at a greater temperature than 100° F., we cannot gain much by drawing the supply through such a heater beforehand, and there is always the risk and inconvenience of its becoming overheated. Likewise with economizers; unless there is a substantial difference between the temperature of the feed delivered from the injector and the economizer temperature the feed-heating device becomes of negative value.

We can now perceive that in this bye-path lurks the one real and economical objection against the injector, for evidently the price of its use may be the sacrifice of feed heating by the waste heat, and it is of serious magnitude. Suppose, for instance, that the working pressure is 140 lbs., that we feed the boiler by a pump of 50 per cent. efficiency through an exhaust heater, raising the temperature of the feed from 100° F. to 200° F. One pound of steam will pump 100 lbs. of water, and the heat thrown away in the pump exhaust is 1,120 British thermal units, whereas the heat abstracted from the heater is 10,000 units. An injector would save the former quantity and reject the latter, which indicates a very

* From the *Electrical Review*, London.

large balance in favor of the combined pump and heater.

From the practical point of view, therefore, we see that it is bad policy to use an injector where feed heating is possible, and that it is also bad policy to use a pump, unless in conjunction with a feed heater. Thus there is a very clearly defined line of demarcation between their two respective "spheres of influence" and utility.

At first sight it does not appear as though the mere question of mechanical efficiency could have any decisive influence on the application of injectors to boiler feeding. It seems quite beside the point, seeing that thermal efficiency is the real desideratum, the which, in this case, is unity. Theoretically, boiler feeding does not imply any expenditure of work; it is simply the exchange of a volume of steam for an equal volume of water; and, since with suitable temperature conditions the steam may be condensed by and form part of the volume of water, there need be no loss of heat in the exchange. We assume, of course, that the levels of water in the boiler and feed tank are the same. There is no work lost, except in the friction of motion; and this appears again as utilizable heat; hence no heat disappears on conversion into work.

Where the mechanical efficiency of the injector becomes a significant factor is, that it may be so bad that there is necessarily a large difference between the feed water as supplied to it and as delivered from it. This temperature difference constitutes a very accurate and, indeed, absolute measure of the injector efficiency. It shows definitely how many unit volumes of steam have been absorbed to deliver each unit volume of water. If the difference is large, the function of feed heaters is, as we have seen, very seriously interfered with, and so a very momentous, though indirect, disadvantage is introduced.

An injector which could take water at, say 60° F., and deliver at 80°F., through a heater in the boiler, or take water from the heater at, say 200° F., and deliver direct to boiler, and do so over a full range of varying loads, could encroach very successfully on the province of the pump. The second condition is apparently impossible unless the water supply is under pressure and the former is probably impracticable over a range of loads, and anything in excess of this would, under average conditions, make the combined efficiency of injector and heater decidedly less than the combined efficiency of pump and heater.

Hutton, in his valuable treatise on "Steam Boilers," states that the average performance of injectors is to deliver from 10 lbs. to 18 lbs. water per pound of steam. Now, at 140 lbs. working pressure, about 200 lbs. water should, in theory, be exchanged for 1 lb. of steam. Hence the mechanical efficiency of injectors ranges below 10 per cent. With the highest theoretical efficiency of exchange, i. e., 100 per cent., the temperature rise of the water injected would be somewhere about 5° F. But Hutton gives a table for the average rise of temperature in practice, which states that with a working pressure of 40 lbs. per square inch, the rise is from 100° F. to 145° F.; at a pressure of 100 lbs. it is from 120°F. to 175° F.; and at 200 lbs. pressure it is from 145° F. to 255° F. It may be possible to obtain better performances than these; but as they stand it is evident that exhaust feed heating in conjunction with such injectors would be scarcely wise.

Apart from the question of feed heating, the injector merits preference above all other appliances for boiler feeding. It is so neat, compact and easily applied, and, at the same time, cheap and effective, that it ought to be in better and more general favor than it is. It would reap better opinions if attention were given to the following points in installing it: Firstly, as a precautionary measure, two injectors of equal size should be used in each instance, and their combined capacity should be about equal to the maximum rate of feed required and ought not to greatly exceed same. Secondly, the two injectors should be mounted quite independently of each other, and so that either can be easily dismantled and overhauled during working hours.

Indeed, these are advisable modes of procedure in the case of any boiler feeding or like appliances. Apparatus that can only be overhauled after hours is bound to receive the scantiest possible attention, and of a sort that is too hurried to be intelligent. Thorough duplication, if not carried to excess, is the truest economy in the long run, saving much in the way of emergency repairs and renewals and securing the best working conditions, and where feasible, it is only just to the attendants to provide it. For steam raising plant is especially exacting in the overtime duty it demands of them, and some thought ought to be given to the lightening of those duties in designing of same.

POWER TRANSMISSION BY BELTS AND PULLEYS.

Such enormous amounts of power have been wasted in the past by belts and shafts and gearing generally, says the *Electrical Review*, London, that the question of a little more or less has not attracted the attention it should have done. Probably, in the future when electrical driving becomes more common and the power to drive a machine can be so easily found, it will become apparent that the direct driven machines use so much less power than belt driven machines that attention is likely to be directed to belts with a view to reducing their frictions and other wastes. Mr. C. L. Redfield some time ago drew attention to the subject in the *Engineering Magazine*. He is of opinion that belts have been neglected in the rush after electrical transmission, this neglect of old methods being a usual custom, and often leading to undue condemnation. In designing a belt system there are many items to consider in arriving at a suitable compromise. There is the shaft diameter and speed, the diameter and face of the pulleys and the belt size, and these are capable of a large number of combinations.

The first loss in a belt is that due to bending it round the pulleys and unbending the same. Though small the loss occurs at four points in each belt. To transmit a given power there must be so many cubic inches of belt pass any given point in a given time. To do this we may either run a large belt slowly or a small belt quickly. The product of area and velocity must be constant.

As the bending force varies as the breadth and as the square of the thickness and as the amount of bend, a 2-inch belt offers simply twice the resistance of a 1-inch belt; a belt ¼-inch thick offers four times the resistance of one only an eighth thick. Hence a 1-inch belt of a quarter thickness has double the resistance of a belt 2 inches by one-eighth. Yet they are equal in area. In respect of shafts their resistance varies as their speed and diameter, and their power varies as their speed and as the cube of their diameters. Thus a 2-inch shaft is eight times as powerful as a 1-inch shaft, and a shaft at 200 revolutions transmits double the power of a shaft at 100 revolutions. Now loss by friction varies as the load or journal pressure multiplied by the speed.

Considered alone the friction speed is a direct function of the diameter: the weight varies as the square of the diameter so that the friction loss varies as the cube of the diameter. A shaft alone, therefore, has an equal frictional loss whatever its diameter. If a shaft carries other load than itself, every reduction of diameter with consequent increase of speed increases the friction. Larger and slower shafting is thus economical when a shaft has extraneous loading. But with high speed of belts the pull of a belt diminishes, and so far a high speed shaft will have a less load on it than if it ran more slowly. This points to economy with small high speed shafts. But the gain becomes small as speeds become high especially, because the friction surface moves a greater distance under the load. Moreover, larger narrow pulleys are heavier than smaller wider ones and add to the load. Centrifugal tension demands greater tightness and the maximum velocity is limited to somewhere from 4,000 to 7,000 feet per minute. The lower limit, we think, is more likely to be the more economical.

A system of shafting is assumed for illustration, driving four machines by countershafts placed two on opposite sides of the main shaft. The calculations are made on the basis of journal friction alone, though some of the changes made from the original plan, as the use of larger pulleys, bring in other economics. The example shown is quite an ordinary arrangement. Calling the coefficient of friction $= k = .075$ and taking out all the pulls and loads, he finds the friction of a 20 horse-power transmission to be 3.602 horse-power. Inspecting the diagram shows that the pulleys driving the countershafts are not close together. By reversing each opposite pair of countershafts, end for end, their driving pulleys come close together, and their belt pulls on the main shaft now partly balance one another.

Again by doubling the speed of the main shaft and halving the pulley diameter the load on the main bearings is reduced, at the expense, however, of the friction velocity, and the result is a loss. Such a change is unprofitable. It does not pay to reduce the 3¼-inch shaft to 2½-inch with reduced belt pulleys. Speed the shaft up and keep the same pulleys and they can be made narrower, and smaller belts may be used having only one-half the pull. This reduces the load on all the shafts and only increases the friction on the main shaft. Starting with an original resistance of 1,584,615, the reversal of the countershafts reduced this to 1,191,575. The next change reduced it to 819,354. If, however, the main shaft had been kept down to 100, and the belt speed had been got up by enlarged pulleys, the countershaft losses would remain as in the last case, but the main line friction speed would be reduced by more than the load would be increased and the total resistance becomes now 720,543.

The next trial is to increase the pulley diameters again all round and put the main shaft again up to 200 revolutions. The result all round is a saving and the total resistance becomes 558,162. But he now observes that the pull of opposite countershafts is uneven upon the main shaft, and he reduces the pulleys on one of them so as to get a balance. This reduces load and friction, for it transfers pull from a large to a small bearing at a lower speed. Having obtained the balance on the main shaft, he then again increases pulley diameters in proportion, and gets up the belt speeds again, and obtains a final resistance of only 463,120, or less than a third of what he began with. The general deduction seems to be to balance pulls on a main shaft driving to two sides. To keep such opposite pulls upon closely contiguous pulleys. To keep shaft speeds low and pulley diameter high. It is, of course, the difficulty in practice to get pulleys as large as one would like. There is not room for them. Designers also look to first cost of pulleys and are exceedingly apt to forget belts, yet where belts are long and good their cost may go a long way towards increased pulley cost. Belts can be narrowed as much as pulley diameters are increased, while the pulleys themselves may be narrower, and they will be easier for the belts and have better grip.

The General Electric Company owed on July 1, 1898, $1,488,200 accumulated dividends on its preferred stock. These dividends have not been paid since July, 1893. The rate of interest is 7 per cent. per annum. Neither have any dividends been paid on its common stock since August, 1893.

LODGE'S SYSTEM OF SYNTONIZED WIRELESS TELEGRAPHY.*

That the Marconi system of wireless telegraphy has achieved considerable practical success is well known. Messages have been sent over a distance of 16 miles, and printed in dot and dash on the Morse ribbon. The number of words per minute transmitted has not been very great when compared with the speed of the ordinary line, but there are many exceptional circumstances in which that drawback may be more than counterbalanced by the several advantages of the Marconi system.

One thing, however, the Marconi system has yet failed to do, that is, to transmit messages which will only be recorded by a single selected receiver. In the early days of the Marconi system there was much talk about this being done, by taking advantage of the principle of resonance; but it has been found that in practice this principle cannot be utilized by the Marconi apparatus. The theoretical conditions under which synchronism or syntony can be made effective in telegraphy by electric waves have been thoroughly investigated by Dr. Lodge, and the results of his investigations have been embodied in practical form in a system of apparatus which has already been explained in general terms, but which we are now able to describe in greater detail.

In Lodge's invention the method of intercommunication consists in utilizing certain processes and apparatus for the purpose of producing and detecting a sufficiently prolonged series of rapid electric oscillations, and in so arranging them that the excitation of a particular frequency of oscillation at the sending station may cause a telegraphic instrument to respond at a distant station, by reason of being associated through a relay with a subsidiary circuit capable of electric oscillations of that same particular frequency, or of some multiple or submultiple of that frequency. Other distant stations will similarly be caused to receive messages by exciting at the sending station alternations of different frequency. Individual messages can thus be transmitted to individual stations without disturbing the receiving appliances at other stations which are tuned, timed, or syntonized to a different frequency. Each station is usually provided with both sending and receiving apparatus.

A complete system of Hertzian wave telegraphy may be said to consist, in its simplest form, of an arrangement shown diagrammatically in Fig. 1, where A represents the emitting apparatus, and B the receiving apparatus. In the emitter illustrated in Fig. 1, electricity from a suitable source, such as

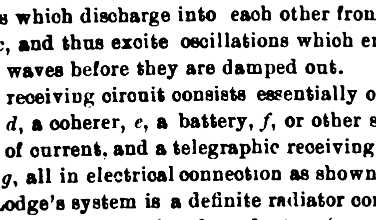

FIG. 1.

a Ruhmkorff coil, a, is supplied to a pair of conductors which discharge into each other from knobs b and c, and thus excite oscillations which emit one or two waves before they are damped out.

The receiving circuit consists essentially of a collector, d, a coherer, e, a battery, f, or other suitable source of current, and a telegraphic receiving instrument, g, all in electrical connection as shown.

In Lodge's system is a definite radiator consisting of a conductor or a pair of conductors (represented by the letters h h^1 in Fig. 2 and following figures). These conductors are of large capacity and may be arranged either as a Leyden jar, or preferably spread out separately in space (one of them being the earth when desired). To h and h^1 respectively are joined a pair of polished knobs h^2 h^3 (protected by glass from ultra-violet light), which form the adjustable spark gap called the "discharge gap." Between either capacity area and its knob is placed a self-inductance coil, i.e., a coil of wire or metallic ribbon, h^4, preferably insulated with any solid or fluid insulator, as in Fig. 2, or in air, and of a shape suitable to attain the greatest inductance with a given amount of resistance. The object of this coil is to prolong the electric oscillations occurring in the radiator, and so constitute a radiator of definite frequency or pitch, emitting a succession of true waves. This renders syntony in a receiver possible, because the exactitude of the response depends on the fact that the total number of oscillations in a suitably-arranged circuit is very great, so that a very feeble impulse is gradually strengthened till it causes a perceptible effect, on the well-known principle of sympathetic resonance.

The electricity is supplied to the radiator by a Ruhmkorff coil, a Tesla coil or an influence machine, in one of three different ways according to circumstances.

The first way is by leading wires from the machine to the two discharge knobs, h^2 h^3, which gives a discharge which follows on a fairly steady electric strain.

The second way consists, as shown in Fig. 3, in having a supplementary pair of spark gaps, h^6 h^7 (which are called "supply gaps"), one knob of each (called the receiving knob) being attached to the middle or other convenient point of each capacity area, h h^1, and the other knob of each pair (called the supply knob) being connected by wires, h^8, to the Ruhmkorff coil a, and brought moderately near the first, so that when the coil is in action the capacity areas shall receive their positive and negative charges by aerial disruption, that is, in a sudden manner, rather than by the slower process of metallic conduction. They are then left to discharge into each other through the connecting coil, h^4, and across the short spark gap between the knobs h^2 h^3. The best width of this gap depends on circumstances, and it may be closed altogether without stopping the action. The gap between the knobs h^2 h^3 may, if desired, be closed by a shunt, h^9.

On the third plan, as indicated in Fig. 4, a Leyden jar or other suitable condenser, j, is intercalated in each of the wires, h^8, leading from the coil, a, to the supply knobs, so that the knobs are supplied from the outer, that is, the uninsulated coat of each jar, while between the inner coats or coil terminals a third spark gap, called the starting gap, also consisting of two knobs, h^{10} h^{11}, is arranged. The outer coats of the jars must not be insulated from each other; they are usually joined by a self-inductance coil of fairly thin wire, k, so as to permit thorough charging. When the discharge occurs, this wire acts as an alternative path, but on account of its self-inductance does not prevent the sparks at the supply gaps.

By both the methods described with reference to Figs. 3 and 4, the two capacity areas, h h^1, which, together, with the inductance coil between them constitute the radiator or aerial disruption or impulsive rush, are charged. The advantage obtained is that charges so communicated are left to oscillate free from any disturbance due to maintained connection with the source of electricity, and therefore oscillate longer and more simply than when supplied by wires in the usual way. Moreover, the capacity areas of the radiator are thus more conveniently employed as the capacity areas of a receiver without need of disconnection.

The arrangement described with reference to Fig. 4 illustrates most completely the method of charging the capacity areas, h h^1, with an impulsive rush.

The action is as follows: The Ruhmkorff coil a charges the jars j, whose outer coats are connected, and discharges them at the starting gap, h^{10}. This spark precipitates a discharge at the supply gaps, h^7 h^8, and suddenly supplies the capacity areas, h h^1, with electric charges, which then surge through the connecting coil, h^4 (divided into two parts in this figure), and spark into each other at the discharge gap between the knobs, h^2, h^3. This last discharge is the chief agent in starting oscillations which are the cause of the emitted waves. But it is permissible in the arrangements, Figs. 3 and 4, to close this last gap when desired, and so leave the oscillations to be started by the sparks at the supply gaps alone, their knobs, in that case, being polished and protected from ultra violet light, so as to supply the electric charge in as sudden a manner as possible.

Spheres or square plates, or any other metal surfaces may be employed as capacity areas, but for the purpose of combining low resistance with great electrostatic capacity, Lodge prefers cones or triangles, or other diverging surfaces, with vortices adjoining, and their larger areas spreading out into space. A single insulated surface may be used in conjunction with the earth, the earth or conductors embedded therein constituting the other oppositely

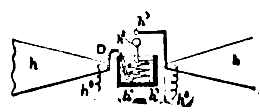

FIG. 2.

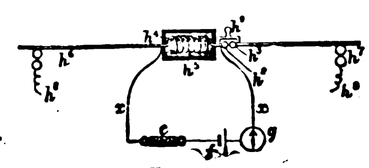

FIG. 3.

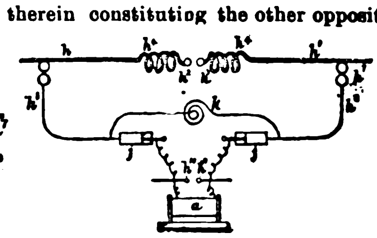

FIG. 4.

charged surface. Radiation from an oscillator consisting of a pair of capacity areas is greater in the equatorial than in the axial direction, and, accordingly, when sending in all directions is desired, it is well to arrange the axis of the emitter vertical. Moreover, radiation polarized in a horizontal plane, that is, with its electric oscillations vertical, is less likely to be absorbed during its passage over partially conducting earth or water. A pair of insulated capacity areas arranged for long distance signaling is shown on the left-hand side of Fig. 5.

Fig. 6 shows a single insulated capacity area, h, with the earth acting as the other surface, and leading up to the spark knobs, h^2, h^3, by a triangular sheet or cone, h^1, so as to afford good conductors even to rapidly alternating currents. The wire, h^8, in this case leads to one terminal of the Ruhmkorff coil, r, the other terminal of which is taken to earth. The capacity area, h, is insulated as shown at h^{12}.

Fig. 7 shows an arrangement which will catch the wind less, and which is fitted with a syntonized coil, h^4.

Fig. 8 shows an insulated metal surface, in the form of a roof, h, of a shed or building, which may be used as a capacity area, suitable connection and apparatus (not shown) for emitting or receiving being placed inside the little house, l.

The self-induction coil, represented at h^4 in all the figures, is a coil of highly conducting wire or ribbon, well insulated by air or by some other medium, as already described, or else covered to a sufficient thickness with insulating material. It may be either a flat coil, enclosing a plane area and shaped so as to have a maximum self-inductance for a given resistance, or it may be a cylindrical coil wound on a finely subdivided iron core, as shown at m, Fig. 9, either ring-shaped, or U-shaped, or straight.

The discharge knobs, h^2, h^3, may be arranged at one end of such a coil as shown in Figs. 2, 3, 7 and

* From the *Electrical Review*, London.

9, or the coil may be in two halves, with knobs inserted in the middle at pleasure.

Several such coils, h^4, h^{4x}, h^{4xx}, with their knobs, h^3, h^{3x}, h^{3xx}, may, as shown in Fig. 10, be arranged for use with a single pair of capacity areas, and any one of them may be brought into action by a suitable switch. Thus the desired frequency of vibration or syntony with a particular distant station may be attained by replacing one coil by another, for the frequency can be adjusted either by varying the capacity of the condenser or jar or other conductor employed, or the charged body, or, on the other

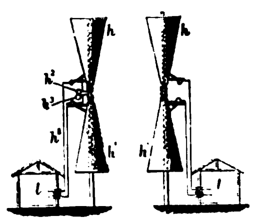

FIG. 5.

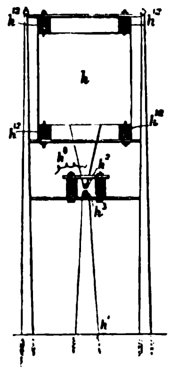

FIG. 6.

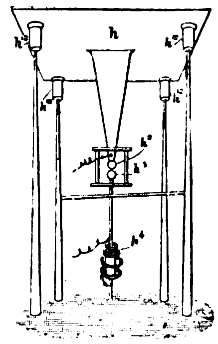

FIG. 7.

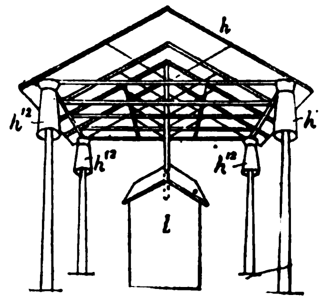

FIG. 8.

hand, by varying the number and position of coils or other portion of the discharge circuit. That discharger is in action whose spark gap is allowed to operate, and a switch, A^1, B^1, C^1, can determine which of a set of different coils shall be utilized. Fig. 11 illustrates the form of switch indicated at Fig. 10.

An alternative plan to that described in Fig. 10 is to connect the capacity areas through one pair of knobs and a single large coil of a considerable number of turns, as shown in Fig. 9, and to have keys or plugs or switches, S^1 and S^2, whereby some of the turns can be shunted out of action, so that the whole or any smaller portion of the inductance available may be used, in accordance with the correspondingly tuned receiver at the particular station to which it is desired to signal. This arrangement may be used in lieu of, or in combination with, interchangeable inductance coils such as are shown in Fig. 10; in the latter case they are useful for correcting slight errors in tuning for any one station.

Another plan, and one well adapted to secure accurate tuning, is to arrange some or the whole of a syntonizing coil so that its parts may be made to approach or recede from one another. The one is named by Lodge an adjustable coil, and the others replaceable or interchangeable coils.

A receiver or resonator consists of a similar pair of capacity areas connected by similarly shaped conductor or self-inductance coil, the whole constituting an absorber arranged so as to have precisely the same natural frequency of electrical vibration as the radi-

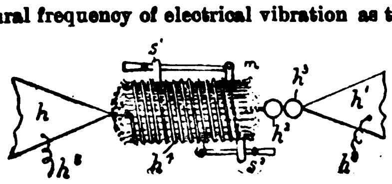

FIG. 9.

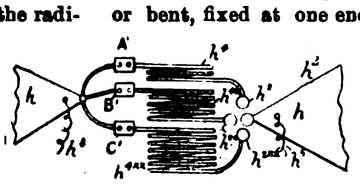

FIG. 10.

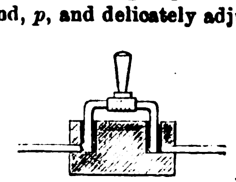

FIG. 11.

ator in use at the corresponding emitting station; but it must not have a spark gap such as h^2, h^3, or if it have a spark gap the same must be carefully closed or shunted, or bridged across by a good short conductor, for example like Fig. 11, before the arrangement can be properly used as a receiver.

Referring to Fig. 3, it will be seen that that diagram illustrates a combined emitting and receiving apparatus. When in use as a radiator, the gap between the discharge knobs, h^2, h^3, is left open. When utilized as a resonator, the said gap is closed by the shunt, h^9 (shown on a larger scale, Fig. 11), and the coherer, c, battery, f, telegraphic receiving instrument, g, are connected through a thin wire, x, from each end of the inductance coil, h (i. e., from each of the capacity areas).

If the Ruhmkorff coil, a, had been actually connected to the capacity areas, h h^1, as in Fig. 2, then it must be detached and substituted by the coherer circuit when a receiver is required; but if the charge has been supplied through gaps as in Figs. 3 and 4 (and this is the best plan), then the Ruhmkorff connection can be left unaltered, as it in no way then affects the action of the resonator, provided always that the coil is not put in action while the receiving circuit is connected up.

A coherer consists of any arrangement which drops in resistance on receipt of an electric impulse, and rises to its old resistance on being subjected to a mechanical impulse, such as a tremor or tap.

A coherer circuit is any known arrangement for observing or recording effects due to fluctuations in the electrical resistance of a coherer.

Lodge makes use of Branly's coherer, in which a pair of conductors are embedded in metallic grains or powder or filings. He prefers to use selected iron filings of uniform size, sealed up in a good vacuum, and with communicating surfaces or electrodes reduced to points of thin platinum wires fused into the glass with their ends close together. Instead of

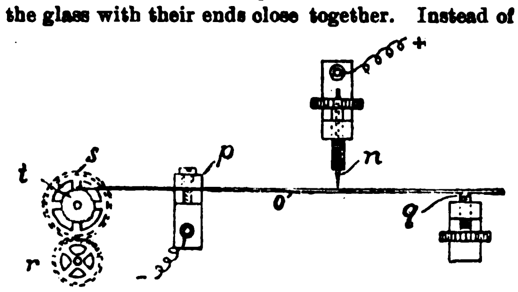

FIG. 12.

the Branly or other well-known coherer, Dr. Lodge also makes use of the coherer illustrated, Fig. 12, wherein a point, n, rests lightly on a flat metallic surface, o. For instance, a needle point of steel or platinum may make light contact with steel or aluminum or other spring like a watch spring, straight or bent, fixed at one end, p, and delicately adjustable by a thumbscrew, q, at some other part, so as to regulate the pressure which it exerts on the fixed needle point.

Whenever an electric wave or impulse from a distant radiator arrives and stimulates electric vibrations in the syntonized resonator or absorber arranged for the purpose, the delicately-adjusted junction of the two metals, or of the metallic or other particles which are connected up to the resonator so as to feel these vibrations, suddenly and greatly changes its electrical resistance, and this diminution of resistance enables a local battery to actuate a relay or a telephone or other telegraphic instrument in circuit therewith.

To break contact again, or to restore the original resistance, any form of mechanical vibration suffices. Lodge mounts on the stand of the coherer either a clock or a tuning fork, or a cog-wheel, or other device for causing a shake or a tremor of sufficient intensity, maintaining it in motion by either a spring or weight, or by electrical means. In Fig. 12, r and s are two wheels of a clockwork train. Upon the arbor (or on a disk mounted thereon) is a series of serrations or the like, t (shown exaggerated in the drawing), which as the wheel rotates effects the vibration of the lever or spring, o. Such a tapper as is used in dentistry likewise serves very well, or the mere motion of any clockwork attached to the stand will suffice. An exceedingly slight, almost imperceptible tremor is all that is usually needed.

The diminution of resistance takes place instantaneously, and contact is broken again in a very small fraction of a second later. The instant it is broken the junction is ready to receive a fresh signal. The rapidity of signaling depends on the quickness of response of the signaling instrument, and it depends also on the rapidity with which the mechanical arrangement can break or interrupt the cohesion directly after the electrical stimulus has established it. Lodge has found that when a telephone is used the coherer restores itself without specially arranged tremor, and that a telephone is the quickest responder that can be used.

In the coherer circuit the coherer is usually ar-

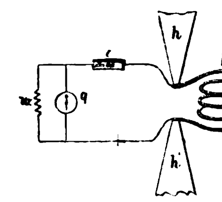

FIG. 13.

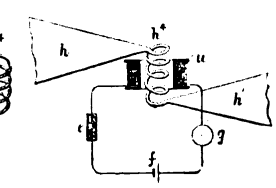

FIG. 14.

ranged with the coherer in simple series with a battery (voltaic or thermal) and a galvanometer or other indicator or recorder of fluctuations of current. The terminals of this series of instruments are then connected to the capacity areas of the receiver close to its self-inductance coil, so that this same coil of wire completes and forms an essential part of the coherer circuit. The coherer is thus affected by every electrical disturbance occurring in the connecting coil or in its capacity areas, and by the aid of the battery at once enables the telegraphic or telephonic instrument to appreciate and indicate the signals. This plan is shown in Fig. 13. It is an improvement on any mode of connection that has previously been possible without the connecting coil.

In some cases Lodge, as shown in Fig. 14, surrounds the syntonizing coil of the resonator with another or secondary coil, u (constituting a species of transformer), and makes this latter coil part of the coherer circuit, so that it shall be secondarily affected by the alternating currents excited in the conductor of the resonator. The coherer is thus stimulated by the currents in the secondary coil, and not primarily by the currents in the syntonizing coil itself, the object being to leave the resonator freer to vibrate electrically without disturbance from attached wires.

In all cases it is permissible and sometimes desirable to shunt the coils of the telegraphic instrument by means of a fine wire or other non-inductive resistance, as shown at w in Fig. 13, in order to connect the coherer more effectively and closely to the capacity areas or receiving arrangement whereby it is stimulated.

Dr. Lodge has not yet published the results of any experiments in which distances have been traversed by means of his signaling apparatus as great as those that have been attained by the Marconi system. A few months ago he informed us that he had transmitted signals over a distance of one mile without any perceptible falling off in the efficiency of the

apparatus. This points to much better results being achieved. The utilization of resonance would appear to indicate that the inconvenience of the long vertical conductor in the Marconi apparatus may be altogether got rid of. The results of further experiments with Lodge's apparatus will be eagerly looked for by those interested in this subject.

THE WERNER LEAD-ZINC-CADMIUM STORAGE BATTERY.*

One of the most interesting modifications of the lead accumulator, but one which has not yet given adequate industrial results, is the lead-zinc accumulator. It was at first studied by d'Arsonval and Carpentier and subsequently improved by Reynier. In this cell the acidulated water is replaced by a sulphate of zinc solution, and the negative plates by sheets of smooth lead or of zinc. The positive plates are of lead, either of the Planté or Faure type. During charge zinc is deposited on the negative electrode and the positive is peroxidized. During discharge the zinc dissolves and the positive plate is reduced to a state of inferior oxidation. This combination offers two advantages over the ordinary lead accumulator: (1) The mean electromotive force of discharge is from 0.3 to 0.4 volt higher. (2) The "specific capacity" is greater on account of the diminution in weight of the negative electrodes. On the other hand, it is difficult in this type of accumulator to ensure a good and solid metallic deposit on the negatives; and, moreover, the zinc which has been deposited dissolves on open circuit, with an evolution of hydrogen, causing the cell to lose its charge rapidly. To stop this local action Reynier reduced the surface of the negative electrodes as much as possible and amalgamated the zinc.

The special feature of the Werner accumulator is the composition of its electrolyte, which is a solution of a mixture of sulphates of zinc, cadmium and magnesium. During the charge a deposition of zinc and cadimum takes place, and at the same time a certain quantity of hydrogen is produced, which combines chemically with these two metals. During discharge this deposit is dissolved, and the useful limits of potential difference are 2.3 and 1.9 volts. As already mentioned, it is necessary, for the realization of a good accumulator with metallic sulphates, to obtain a good and hard metallic deposit on the negative plates, which does not get used up on open circuit. M. Werner has found that a second condition must be added, a condition in many cases contradictory to the first—that a good peroxidation of the positive plates be obtained, the peroxide of lead possessing a high degree of what M. Werner calls "molecular permeability"—a thing not to be confounded with internal resistance. When a well-formed mass of peroxide is being discharged the particles close to the grid are used up more than the remainder of the material. Gradually, however, an inter-molecular action takes place, which tends to restore the homogeneity of the material. Now it is observed that for the same positive plate and the same electrolyte resistance this inter-molecular action characterizing the "molecular permeability" is more or less rapid according to the composition of the bath and its temperature. The two conditions mentioned above are contradictory, because, to obtain a good deposit on the negative plate, a very concentrated bath is necessary, but when the bath is concentrated the "molecular permeability" becomes insufficient, this being shown by the rapid fall in the potential difference between the terminals of the cell—the cell becomes "fatigued" too quickly. For example, with a concentrated bath of zinc sulphate hardly any peroxide is formed on the positives. With a bath of concentrated sulphate of cadmium peroxide is certainly formed, but the useful potential difference, which is 2.4 at the commencement of the discharge, falls to 1.8 volts when only 10 per cent. of the total charge has been utilized. After a rest of a quarter of an hour, the discharge can be resumed at 2.1 volts. M. Werner found that, in presence of sulphate of magnesium, the deposit of zinc and cadmium is very regular, even in a weak bath; at the same time the molecular permeability of the positive plate is considerably increased.

M. Werner constructs two types of negative plates: one for relatively low discharge rates, the other for rapid discharges. For instance, for a discharge in six hours, which is required for electric carriages, the negatives are made of very thin sheet iron covered previously, by immersion, with a layer of lead. As the concentration of the bath diminishes gradually as the cell charges, it is useful to diminish the charging current also. This occurs automatically when the cell is charged at constant potential, and this is the treatment preferred. At the commencement of the charge the zinc-cadmium deposit is crystalline with a fine texture; towards the end it becomes amorphous, less hard and more spongy. The charge is stopped when 60 per cent. of the salts has been decomposed. The waste on open circuit depends on the nature of the bath and on the quality of the deposit. When cadmium is predominant in the bath, so that an initial electromotive force of 2.4 to 2.48 volts is obtained, the waste on open circuit would be very small and would not exceed 3 per cent. of the total deposit per diem. It may be mentioned that it is only the negative plate that wastes on open circuit, so that if by overcharging a deposit is produced on this plate more than sufficient for the positives, the waste on open circuit only diminishes the efficiency and hardly diminishes the capacity.

For rapid discharge accumulators another type of negatives is used. In this case it is impossible to employ a concentrated bath, but with a weak bath a very spongy deposit is obtained, and a considerable quantity of hydrogen, whose escape it is of advantage to prevent. This has led to the construction of plates made of a very thin and light grid, covered with a paste of lead and spongy cadmium, the whole being submitted to great pressure. In this manner plates are obtained which are at the same time strong and light and which receive the metallic deposit and the hydrogen in their pores. The waste on open circuit is practically *nil*. These plates have been especially employed in accumulators for lighting trains, where they have to be charged and discharged in 2½ hours.

For the positive electrodes two things have to be considered: the weight of active material and the surface of adhesion of this material to the support. The total capacity of a positive plate only depends on the weight of active material, but the useful capacity decreases as the discharge-rate increases, but this decrease is less the greater the surface of adhesion between the material and its support. Whatever the conductivity of the active material, the portions in contact with the grid are exhausted quicker than the remainder, and the difference of potential at the terminals falls to below the useful limits before all the active material is exhausted. It appears useless, therefore, to increase the weight of the active material when the surface of adhesion is not great enough. According to M. Werner the insufficiency of this surface is the principal cause of the premature destruction of the positive plates. It is known, in fact, that of all the oxides of lead the peroxide alone is not attacked by sulphuric acid. With a small surface of adhesion, parts adhering to the grid are completely discharged and pass to the state of inferior oxides which are easily sulphated. This is why a white layer of lead sulphate is always found when an old oxide positive plate is broken. Guided by the above considerations, M. Werner tried to increase the surface rather than the quantity of active material supported by the grid. The positive plate is formed of a strong grid with wide pastilles (4 by 5 cm.). On the two sides of the grid are soldered, upon a stay, two or four thin sheets of lead wire-work, resembling metallic cloth. The whole is subjected to a Planté forming, so that a layer of peroxide 1 mm. thick is obtained. The grid is then filled with lead peroxide paste and minium and is subjected to a very great pressure. Thus a mass is obtained which is traversed everywhere by lead wires. These positives are strong and of large capacity and they have nothing to fear from rapid discharges.

The Werner lead-zinc-cadmium cell gives, according to the inventor's figures, 37.2 watt-hours per pound of plates when discharged at 12 to 15 amperes, corresponding to 16.3 watt-hours per pound of cell complete. It is stated that an electric carriage fitted with these cells has been running in London for some time past. This carriage has a battery weighing 737 lbs., consisting of 30 cells of 180 ampere-hours' capacity at 30 amperes discharge.

* Abstract of an article from *L'Industrie Electrique* in *Electrician*, London.

VIEWS OF THE SCIENTISTS.*

The Magnetic Deflection of Diffusely Reflected Cathode Rays.

By Ernest Merritt.

It is not known that X-rays are developed in a Crookes tube at all places where the cathode rays encounter a solid obstacle. In the tubes now made the cathode rays are usually "focused" on a piece of sheet platinum, and the X-rays proceed from this focus. But other rays are developed at this point as well as Roentgen rays and are the cause of the brilliant fluorescence which usually covers about half the glass of such tubes. These rays are deflected by a magnet like cathode rays; in this they differ from X-rays, which are entirely unaffected by the most powerful magnetic field. Goldstein, who first observed these rays, believed them to be cathode rays that had been diffusely reflected from the platinum, just as light would be scattered by a roughened surface. S. P. Thompson believed that the rays were intermediate between cathode rays and X-rays, and has proposed for them the name "para-cathodic rays." The author has measured the deflection o the "para-cathodic rays" in a given magnetic field and compared it with the magnetic deflection of the direct cathode rays in the same tube. No difference could be detected in the behavior of the two sets o rays. This fact must be looked upon as an argument in favor of Goldstein's view. According to the generally accepted theory cathode rays consist of small negatively charged particles repelled at enormous speed from the cathode. It seems probable that when these particles strike an obstacle some are stopped and by their impact produce the X-rays; a few of the particles may, however, rebound like elastic balls. The particles that rebound will then travel off with practically undiminished velocity and will form the "para-cathodic rays," possessing all the properties of the original cathode rays. The author is therefore of the opinion that "para-cathodic rays" are really the same as cathode rays, and result from diffuse reflection.

Methods of Determining the Frequency of Alternating Currents.

By Carl Kinsley.

We have all noticed the hum of a transformer or alternating current arc light machine. Upon the pitch of that note depends in a great measure the current of electricity that exists in the wire. It is consequently of importance to electricians to determine the frequency of the alternations which produces the low note in electrical apparatus. If the

* Abstracts of Papers read at the recent Convention at Boston of the American Association for the Advancement of Science.

current flows through an electro-magnet it will turn it into a pulsating magnet which will make a piano wire, tightly stretched, vibrate as though it had been struck. From the force used to stretch the wire, the rate of vibration of the wire and consequently of the alternating current can be calculated.

The same thing occurs when an iron strip is held in front of the magnet. Upon the length of the strip depends the rate of vibration, and that is easily calculated from the strip itself. Dr. John Hopkinson first used the piano wire and Dr. Campbell the iron strip.

Another way is to have a little of the electricity flow through a telephone receiver. The hum of the telephone will show just how fast the current is alternating. This rate of vibration can be measured by making the air in a long tube vibrate in unison with the telephone. It is merely necessary to measure the length of the tube in order to compute how fast the current is alternating. This method is capable of great rapidity of operation and accuracy in getting the result.

Still another method, which can be most easily used of all of them, consists in varying the rate or vibration of a metal strip, not by changing the length, but by hanging weights on the bar. Or else one weight may be used and its distance from the end of the bar varied. When the electrical current passes through the magnet the weight is moved until the bar vibrates. Then the position of the weight will tell the experimenter how many times a second the bar vibrates and consequently how many alternations per second the alternating current has.

On the Electrical Properties of the Vapors from the Carbon Arc.

By Ernest Merritt and O. M. Stewart.

The air, as well as other gases, is usually a non-conductor except when at a very high temperature. The gases from a flame, however, are to some extent conductors of electricity. They possess the power, for example, of discharging an electrified body with which they come in contact. Other gases acquire this discharging power when acted on by X-rays and retain it for a fraction of a second. The authors find that the vapors from an arc light behave in almost exactly the same way as do gases which have been acted on by X-rays, except that they retain their discharging power longer. If the vapors are drawn from the arc through glass or metal tubes, and caused to pass between a charged body and one that is grounded, the former will gradually lose its charge. The discharge current is however not proportional to the potential difference, but increases less rapidly than the latter and approaches a limiting value. If the vapor of water is introduced into the arc the rate of discharge is greatly increased. All the phenomena observed may be explained upon the assumption that the air is "ionized" by passing through the arc, i. e., the molecules of air are to some extent torn apart so as to form positive and negative ions as in electrolysis. These ions rapidly recombine, and their number being limited the maximum current that can be carried by the vapor is relatively small.

The experiments probably have an important bearing upon the theory of conduction in the electric arc.

The Contact Resistance of Similar Metals.

About three years ago, says the *Electrician*, London, M. Edouard Branly, while experimenting on the contact resistance of dissimilar metals, found that for some metals and alloys (copper, zinc, brass, silver, german-silver, etc.) the contact resistance had a very small value, whereas for others (iron, aluminum, lead, bismuth, etc.) the value was unexpectedly high under certain conditions. In the *Comptes Rendus*, of July 25 last, he describes experiments made with similar instead of with dissimilar metals. A column, outwardly resembling a Volta pile, was made by threading 45 disks, 35 cm. diameter and 6 mm. thick, of the metal under test on an ebonite rod and submitting the column to a slight pressure. In the case of aluminum, iron and bismuth the resistance was low if the disks were placed on one another gently; but if dropped on one another with a slight shock and subjected to the same pressure as before, the value of the resistance increased enormously. With disks of zinc, copper or brass, on the other hand, the resistance was practically zero however the column was put together. The following figures show the order of the phenomenon: A column of aluminum disks gently placed on one another, and subjected to 2.6 kilograms pressure, had a resistance of 1.5 ohms. By dropping the disks on one another, and subjecting the column to the same pressure, the resistance was 40 ohms, diminishing to 19 ohms after 24 hours. On taking the column to pieces and remaking it gently, but without cleaning the disks, the resistance was 2.2 ohms, and when again remade by dropping the disks upon one another, the resistance was as high as 215 ohms. Connecting the column between the spark terminals of a radiator reduced the resistance to 0.5 ohm. The same effect was noticeable with iron and bismuth, but in a slightly less degree. No attempt is made to account for the phenomenon.

New Blood Circulation Theory.

There is a new and interesting theory of the circulation of the blood put forth by Dr. M. J. Rodermund of Wisconsin. Dr. Rodermund believes the blood is driven through the arteries and veins by the oxygen in the lungs and not by the muscular contraction of the heart. Instead of the blood carrying the oxygen through the system he thinks it is the oxygen that carries the blood, thus exactly reversing the theory held by physiologists since Harvey's discovery of the circulation of the blood three centuries ago. The Wisconsin physician at least makes out a plausible argument for his new theory, and the article in question is likely to set the doctors and physiologists of the scientific world to thinking and talking.

Dr. Rodermund boldly challenges the generally accepted doctrine that the heart acts as a force pump. He says that the heart is merely the automatic "governor" on the engine to keep the pump from working too fast, and that the real motive power of the blood is the oxygen of the air, acting by electrical energy. It is a well-known law in physics that all positive electric bodies repel each other, while negative and positive bodies attract each other. Dr. Rodermund holds that the oxygen in the air cells of the lungs charges the blood corpuscles with positive electricity, which causes them to be driven violently away through the arteries, and furnishes them with force necessary to make their way through the network of tiny capillaries throughout the body. The moment they have gotten through and have had the oxygen absorbed out of them by the muscles and organs they become negative electrically and begin to be attracted back to the lungs through the veins. As soon as they get back into contact with the inflated air cells they are recharged from the fresh air in the lungs and the process is repeated. Thus Dr. Rodermund would have us believe the diaphragm and the lungs are the machine of perpetual motion called life, and not the heart, as generally supposed.

In support of his theory, the Wisconsin doctor urges that it would be impossible for so small an organ as the heart to do the enormous work ascribed to it. He has calculated that the task of driving the blood through the hair-like tubes of the circulatory system is equivalent to raising 200,000 pounds a foot high every hour, night and day. This would mean that the heart raises the equivalent of its own weight 20,000 feet every hour through a lifetime—which Dr. Rodermund thinks is impossible and preposterous. He thinks it is the electrical energy in the atmosphere that does this work, and cites the effect of holding one's breath and other similar experiments to prove that the lungs are the organ of life and the heart only a minor attachment.

WELSBACH'S NEW ELECTRIC INCANDESCENT LAMPS.*

There have been many rumors afloat of late respecting the latest inventions of Dr. Auer von Welsbach, which are directed toward the improvement of the electric glow lamp in respect both of duration of service and light efficiency. In both these directions it must be admitted there is room for substantial betterment, and Dr. Welsbach will deserve well of the public and will reap a substantial reward should he succeed in realizing the expectations he has raised.

The publication of certain patents recently granted to Dr. Welsbach suffices to give a general outline of the direction in which he is working.

The patents here alluded to describe two kinds of glow-bodies for use in incandescent electric lamps. The first is a fine filament of osmium of a peculiar form. Osmium is one of the metals of the platinum group, generally found in nature in the form of flat irregular grains, associated with iridium in the mineral called osmiridium. It may be obtained in the pure state by a chemical method of separation, in which advantage is taken of the fact that the tetroxide, which is readily formed by heating the metal in the air, is a volatile compound. It must be prepared, however, with great care, because of the extremely poisonous character of its fumes.

The second glow-body described is one formed of "thoria," an earth-metal oxide which is already largely employed in the preparation of the well-known Welsbach incandescent gas mantles.

Referring to the osmium filament, the basis of its selection as the substitute for the carbon filament is the claim made by the inventor that it does not volatilize at the highest attainable temperature when confined in a vacuum or surrounded by a reducing atmosphere.

A serious difficulty with the carbon filament in the ordinary electric glow-lamp is the rapid darkening of the glass by the deposit on the inner surface of the glass bulb of carbon, volatilized by the heat of the current, or mechanically worn off by its passage. From this cause the light emission of the common electric glow-lamps is rapidly reduced and it occasionally happens that they must be discarded long before the filament itself is broken. It is principally to avoid this defect of the carbon filament that Welsbach has had recourse to osmium. The present difficulties attending the production of his osmium filaments, however, are so great that it appears gravely doubtful if the method can be made commercially valuable.

The fact that it is impracticable to fuse osmium (and on this great infusibility its value for Welsbach's purpose depends) makes it impossible to obtain it in any other form than that of a powder which cannot be united into a solid mass by pressure and then drawn into wire. It becomes necessary then to obtain the osmium filament by indirect means, and for this purpose Welsbach deposits it on a fine platinum wire maintained in an atmosphere of hydro-carbon vapor mingled with water vapor (*sic*); and the platinum wire being heated to incandescence in this atmosphere by the electric current, small quantities of the vapors of osmium tetroxide are blown in from time to time. The result is that a thin layer of metallic osmium is deposited on the platinum wire. This operation, it would seem from the published account, is a slow and exceedingly delicate one, for the deposited film must be quite uniform to answer the purpose, since any irregularity

*From the Journal of the Franklin Institute.

in the deposit would affect the uniformity of its resistance and yield a light more brilliant in spots. Another method of obtaining the deposit is described, which consists in drawing the fine platinum wire through the solution of an osmium salt and then glowing it in a vacuum. To obtain the film in the required condition, by this method, only an infinitely thick layer must be formed at a single operation, so that it must be repeated many times (100 times at least) to obtain the needful uniformity in the superposed layers. Neither of these methods, therefore, seems to present much promise of success on the commercial scale.

A more practical method suggested is to use vegetable or animal fibers as the foundation for the osmium coating. A liquid pulp is made by mixing the finely comminuted osmium oxide and the fibers with sugar solution or other organic cementing material, and, after drying and cutting into the required shape for the lamp, it is glowed slightly in an atmosphere of reducing gas. By this and slightly modified methods a carbon skeleton is formed carrying a certain quantity of unconsolidated osmium. These methods appear practical, but it will be observed that the resulting filament is not a pure osmium filament, but one consisting largely of carbon, and hence open to the same objections as the common carbon incandescent lamps, besides being vastly more costly.

The second proposal of Welsbach is the thoria filament.

This substance, as above remarked, is one of the rare earths largely used in the manufacture of the Welsbach gas mantles, and is known to possess light-emitting qualities of a high order.

To obtain this filament the inventor employs an extremely thin platinum wire (0.02 millimeters in diameter) approximately as thin as a single fiber of the silk cocoon, and draws this successively through elastic cheeks which are kept moistened with a solution of salt of thorium. After each drawing the wire is glowed, and the operation must be repeated, as in the one above described, many times, in order that the resulting coating may have the necessary permanency.

The resulting thread then is a platinum core, surrounded by a dense incrustation of thoria. The heat-resisting qualities of the incrusting oxide are said to be so great that the platinum wire within may be melted without affecting it, while the amount of heat radiated from the brilliantly luminous thoria is comparatively small. With the current intensity employed for ordinary illumination, however, the platinum core is not melted, the explanation being that the greater part of the heat energy imparted to the platinum is transformed by the fireproof encrusting material into light; the intense power of the coating to emit light withdraws and transforms much of the heat of the metallic conductor into light.

The above description gives merely an outline of the several methods set forth in Welsbach's recent patents. In view of the great expectations raised by the reports of his remarkable laboratory work, it must be confessed that the outcome is a disappointment. While the methods proposed are ingenious, they seem to be altogether too delicate to be capable of being commercially applied, and they are undoubtedly so costly as to place serious competition with the cheap electric glow lamp, with which we are familiar, out of the question.

Electrical Ash Hoists and Deck Drills.

A company in Woolwich, England, is said to have recently introduced a new motor-driven ash-hoist which will be of great service to marine engineers and shipowners. There are two side frames of cast iron carrying the small drum on which the rope connected to the ash bucket is raised. The side frames can be fixed to the deck. The spindle of the drum is connected to the motor in the usual way. The same firm are also introducing electric deck drills, which are extremely simple in construction and convenient in application. The smallest of these is for actuating drills up to a diameter of ⅜ in. It is of considerable weight, and the operator applies it by holding it by two handles fastened at the side. The weight of the machine provides the feeding arrangement. There is speed-reducing gear inside the machine for reducing the speed of the motor to the required speed of the drill. The power is transmitted between the motor and the drill by means of flexible gearing. There is a larger drill also with reducing gear, but this is of a larger size, and can work a drill up to 2 in. diameter. The feeding arrangement is by means of a screw and small hand-wheel, or by means of a nut and small lever inserted into a hole in the nut, as in the case of the ratchet brace. There are three speeds to this drill.

THE FIRST ELECTRIC MOTOR CAR.

L. F. Andrews of Des Moines, Iowa, furnishes the Chicago *Record* with the following facts in connection with the origin of the electric motor car. The statement was suggested by a personal mention of Abner C. Goodell, in which it was said of Mr. Goodell that "he worked on the first electric motor ever constructed, which afterward ran between Baltimore and Washington." Mr. Andrews says:

"The electric motor here referred to was the invention of Prof. George C. Page, tested in 1851. It was a failure in practical results and was abandoned, yet it demonstrated the fact that a speed of nineteen miles an hour could be secured with a locomotive built upon his principle.

"It was not until 1877, in San Francisco, that a railway was electrically operated, and that was by Stephen D. Field. It was his pattern of locomotives that was so successfully operated during the Columbian Exposition in Chicago in 1893. Mr. Field simply had perfected and utilized an accidental discovery of reversible dynamic power as made by Gramme of Paris in 1872.

"As a historic fact the first electric motor was the invention of Thomas Davenport, assisted by Orange A. Smalley and Collins Andrews. It was made at Brandon, Rutland county, Vt. Mr. Davenport was only an ordinary blacksmith, going to perform with the force and energy which was wrapped up in 'galvanic magnetism.' He at once began the development of his idea. Ignorant of mechanics, he enlisted the aid of Andrews and Smalley, both practical machinists, and the latter the inventor and maker of an automatic machine for cutting the screw threads of nuts and bolts.

"It was not until 1835, after four years of labor, that a successful motor was completed. The power used was galvano-magnetic. The track was circular and of about eighteen inches gauge, on which a small platform car was run, having a seat for two persons. As I frequently rode upon it, I can safely aver that it was an electric railway.

"In 1847 Moses G. Farmer constructed an electro-magnetic motor on the principles developed by Davenport. His machine was exhibited through the Eastern States. The power was generated from forty-eight pint-cup cells of a Grove battery. The difficulty with the Davenport, Farmer and Page motors was the great cost to run them, and for economic reasons they were abandoned. It was not until the dynamo came that Davenport's thought was completely evolved. Mr. Smalley wrote me a letter a short time before his death, which occurred not long ago. He said: 'Work has been done on the machine since I left it in 1835, but nothing has been added to the principle. Give electricity seventy years, with the talent now available, and there will be no need of overhead wires or underground conductors. Lightning will be made to order sufficient for any purpose.' It is quite pertinent here to say that while Davenport was working out his motor a wire was run between his house and that of Smalley, over which messages were transmitted by electricity."

Coherers.

The actual change which takes place in a coherer when it responds to an electric wave is a matter of great interest to wireless telegraphists. Some Italian physicists succeeded already in demonstrating a cohesion produced in an emulsion of mercury drops in oil. L. Arons has been studying the occurrences in coherers under the microscope. They were prepared by cutting a fine line across a thin strip of tinfoil stuck on glass, laying a little metallic powder over it, adding a drop of Canada balsam, and covering with a cover glass. Thus the whole field of action could be brought within the range of vision. The Canada balsam did not in the least interfere with the efficiency of the coherer, a fact which gives some idea of the energy of the reaction. The newly-prepared coherers had an infinite resistance. On exposure to waves full contact was as a rule immediately produced, especially when the particles were at all dense. Under the microscope violent commotions and a play of sparks were observed among the particles. The green sparks between silver particles were especially bright. Usually the contact may be annulled by tapping. Sometimes, especially in the case of brass filings, one or two particles stick on hard and their surfaces show signs of oxidation. They must then be removed by a brush. When the particles are embedded in Canada balsam a light pressure on the cover glass suffices to annul the conductivity.

A peculiar phenomenon observed is the destruction of contacts by a repetition of the vibrations which produced them. That this does not occur in the usual forms of coherers is probably explained by the fact that the large number of new contacts formed neutralizes the effect of the breakages. In all cases the coherers showed signs of wear after repeated use, especially the embedded coherers. In the latter the liquid was found to contain minute bubbles. On one occasion, when the cut across the tinfoil (0.019 mm. wide) was particularly smooth and straight, the author exposed it to waves without powder. In this case a number of small sparks played across the edges, and the resistance fell to 10^7 ohms. Under the microscope the intervals appeared pretty evenly covered with a fine brown deposit, divided from the tinfoil by a very narrow line. The tinfoil itself appeared somewhat frayed. The brown deposit, which consisted of oxidized tin dust, could be easily taken off with a brush. The importance of this particular experiment, in face of Auerbach's results, lies in the fact that the reaction could hardly have been anything but purely electrical.—*Electrician, London.* [Abstract of paper by Arons, in *Wied. Ann.*, No. 7, 1898.]

Electricity to be Generated on the Nile.

One of the most interesting announcements of the day is that of the assured progress of tapping the river Nile at its higher level above the Cataracts, conducting the water to vertical shafts, down which it will fall to drive turbines, then using the power so generated to run dynamos, from which electricity in the form of alternating or continuous current will be transmitted to points near or remote. The water, after passing through the turbines, will be restored to the river at a lower level or else used to irrigate the land. There will be no waste of material, as in burning coal, and no smoke. Electricity will be applied, not only in pumping for the irrigation, but in driving machinery for preparing the raw products of the soil, spinning cotton, weaving silk and various other industries. But even this surprising scientific scheme is eclipsed by the later proposal, to raise water to an elevation by the sun's rays and use it to run a water wheel and dynamo—the water being

contained in tanks within a structure of glass similar to a conservatory; the sun's heat, expanding the air in the first tank containing water, forces it into the tank above, the air being cooled by screening the tank, and the water then raised to the next tank. The sun's rays acting on a square mile will, it is calculated, furnish one million horsepower, and, with a temperature of fifty degrees in the glass houses outside, the efficiency of the arrangement is elieved to be practicable.

Decomposition of Compounds by Electrical Oscillations.

In some recent experiments by Alexander de Hemptinne, various organic compounds were exposed in the gaseous state, at low pressure, to the influence of electrical oscillations, and the decomposition products were examined. From methylic and ethylic alcohols, mixtures of carbonic oxide, carbonic anhydride, hydrogen and methane of ethane are obtained, and as the quantity of oxides of carbon is diminished if the decomposition occurs in the presence of phosphorus, the author considers these compounds to be due to secondary actions, the primary reaction being represented by CH. OH = CH O; analogous decompositions occur in the cases of propylic, isopropylic and allylic alcohols. With acetone and propaldehyde, however, the presence of phosphorus causes no diminution in the quantity of oxides of carbon; these are hence produced in the primary decomposition, which is in each case CHO = CH CO.

Acetaldehyde undergoes an analogous decomposition, but acetic and propionic acids decompose with the formation of oxygen and the unsaturated hydrocarbon. Methylic acetate and ethylic formate give the same decomposition products, and the chemical formula gives no indication, in the author's opinion, of where the strongest mechanical attraction occurs. A few liquids were also exposed to the oscillatory discharge, and glycerol, glycol, glyoxal, glyceric acid, and oxalic acid were all found to be partially decomposed. Phenol and benzoic acid yielded oxides of carbon and hydrogen, and resinous compounds, the latter, together with hydrogen and acetylene, also being formed from benzene. The above is an abstract in the *Electrical Review*, London, of a paper in the *Zeitschrift für Physikalische Chemie* by Alexander de Hemptinne.

LONDON NOTES.

[From our London Correspondent.]

Bradford Electric Tramways.

These new municipal tramways which have just been opened are supplied with current from the municipal lighting station. Altogether the two sections (Bolton Road and Great Horton) measure from seven to eight miles of single track. They are equipped partly with the side pole system and partly with the center pole. The latest Dawson type of swiveling arm trolley is used. Some of the gradients are 1 in 14, and there are some rather sharp curves. The overhead trolley wire is of .325 inch hard drawn copper. The line is as usual divided into half mile sections which are controlled from feeder switch pillars fitted with six plug switches, test terminals and lightning arrester. The rails, which are 105 lb. girder type, are bonded with Chicago crown flexible bonds, and at 120 ft. intervals cross connection bonds are placed. The car bodies, built by the Brush Electrical Engineering Company, are mounted on Peckham cantilever extension trucks. Each car has two Westinghouse No. 49 slow-speed single reduction motors. The armatures are of the drum type. Westinghouse No. 90 brake series parallel controllers are used, the controllers being so arranged as to utilize the motors for electric brakes. There is a standard platform switch at one end of the car and an automatic switch cut-out at the other end. There is a special tramway switchboard placed in position at the municipal lighting station, where the necessary additional plant for the tramways has been installed. This switchboard stands three or four feet distant from the wall. It has feeder panels, generater panels and the usual Board of Trade test panel. Measuring instruments and an automatic circuit breaker of the Cutter type are fitted to each panel. The principal contractors for the construction and equipment of these tramways were the Westinghouse Electric Company, Ltd., of London. Mr. A. H. Gibbings is the borough electrical engineer.

LEGAL NOTES.

Mrs. Frances A. Henderson has brought suit in the Circuit Court at Newark against the North Jersey Street Railway Company, claiming $25,000 damages. She was riding on an open Elizabeth trolley car on June 1 and dropped her pocketbook. She signalled to the conductor to stop, but before she could fairly get off, the complaint says, the car started up again and she was thrown violently to the ground.

On the 29th ult. at Philadelphia, Henry J. Hartley and twenty-three other stockholders of the Penn Electric Light Company filed a bill in equity in Court No. 2 against the company, J. Lowber Welsh, Thomas Dolan, William Wood, Richard Brock, Clement B. Newbold, George W. Hill, John Boyd and A. J. DeCamp, individually and as trustees of the "Electric Trust of Philadelphia," asking that the defendants be ordered to make discovery in certain transactions and account for profits alleged to have accrued to them. The litigation follows in its general outlines other similar proceedings previously brought. The complainants, as minority stockholders of the Penn Electric Light Company, aver that some of the defendants obtained a controlling interest in the corporation, and used its underground conduits, which were its principal property, in a manner other than for the best interests of the stockholders, by allowing some of them to remain idle and entering into contracts by which the control of the other conduits was given to the Edison Electric Light Company, the Pennsylvania Heat, Light and Power Company and the Pennsylvania Manufacturing Light and Power Company.

The Capital Traction Company of Washington, D. C., on the 27th ult., filed its answer in the suit for infringement on a patent brought recently by the Electric Railway Equipment Company of Virginia. It was alleged that the Capital Traction Company was using a current collector for electric railways which had been patented by one Frederick A. Anderson, who had assigned all of his rights to the complainant company. The answer declares that the Capital Traction Company knows nothing of the complainant and denies that Anderson was the originator or inventor of the apparatus in question. It is also denied that letters patent were lawfully issued to Anderson, the claim being that they are invalid and void. It is alleged further in the answer that the current collectors were manufactured and were in use and on sale in this country two years before Anderson filed application for patent.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILWAYS.

Conneaut, O.—The city council has passed the ordinance granting a franchise to the Pennsylvania & Ohio Railway Company. The proposed street car line will give Conneaut connection with Ashtabula, Geneva, Painesville and Cleveland.

Fostoria, O.—The purchase of the lines and franchise of the Northwestern Ohio Natural Gas Company in this city, and the lines, plant and franchises, gas and electric, of the Fostoria Light & Power Company, for which Samuel R. Bullock, of Philadelphia, has been working since last February, has been consummated. Mr. Bullock is still desirous of securing the belt line belonging to the city and will probably succeed in so doing. It is his intention to put in a gas and electric plant, furnishing both fuel and illuminating gas, municipal, commercial and domestic electric lighting. After the completion of the plant the plant of the Fostoria Light & Power Company will be installed in the new building, giving him a double plant in both lines.

Jackson, Miss.—Gen. S. T. Carnes, to whom a franchise has been granted by the council for an electric light plant and street railway, says that work on the same will begin not later than September 16.

Lawrence, Kan.—The city council has granted a 30-year franchise to the Lawrence Railway Company to build and operate an electric street railway here. The construction of the line is to begin inside of sixty days.

North Tonawanda, N. Y.—George P. Smith of this place, one of the promoters of the Buffalo, Tonawanda & Niagara Falls Electric Railroad, says it is the intention to have a double track road from Buffalo to Niagara Falls in operation by the first of July next year. The road running from Niagara and Tonawanda streets in Buffalo to Tonawanda will be part of the system. To finish the projected line it will be necessary to build 40 miles of track. Mr. Smith says the new railway will run as near the old river road as possible, the directors believing the beautiful scenery along the Niagara will attract passengers. The company has a franchise now to run between Tonawanda and Niagara Falls, and the common council of Niagara Falls has an application before it for permission to allow the road to enter that city.

Plainfield, N. J.—The Brunswick Traction Company, which obtained a franchise some time ago to extend their line from Bound Brook to Dunellen, had to do some hustling to save their franchise. The franchise required that the line should be running by August 30, but the track was not wholly laid on that day, and much of what was laid was covered with earth; the only part that was any way passable was about two miles in that part of Dunellen where it joins the Plainfield trolley tracks. The company had no cars and borrowed an old flat car from the Jersey Central Railroad. This was lifted on the available tracks, a team of horses attached and with the New Market band and the borough council aboard the "line" was started. The two miles were made in two hours, finishing just before the fateful hour of midnight. Part of the time the car was off the track, but all hands turned to and set it on again. The franchise was saved, but it was a close call.

Sedalia, Mo.—The Sedalia Electric Railway and the Sedalia & Brown Springs Railway, purchased on the 26th ult. by Stewart & Co. of New York, will be consolidated under the name of the Sedalia Electric Company. The officers are: S. H. G. Stewart, New York, president; John D. Crawford, Sedalia, vice-president; Carlton H. Reeve, New York, secretary and treasurer. The directors are the above officers and A. C. Zimmerman, New York, and W. H. Powell, Jr., Sedalia.

West Bay City, Mich.—The Business Men's Association has decided to assist the proposed electric railroad to Flint. At least $100,000 worth of patronage is to be assured. A Chicago company will build the road.

LIGHTING PLANTS.

Atlanta, Ga.—At a public meeting held here to discuss municipal affairs a resolution was passed requesting the committee on arrangements for the October primary election to prepare a ballot for the voters on the question "For or against the public ownership of an electric lighting plant."

Atlantic City, N. J.—Mayor Thompson has again vetoed the ordinance granting John H. Rothermel & Co. of Reading, Pa., a five-year franchise for an electric light plant, and the city council has again passed the ordinance over the mayor's veto. Although the ordinance is thus sustained by the council, the Rothermel Company cannot proceed to erect its plant until the actual contract is signed by the mayor. Certiorari proceedings are likely.

Chicago.—Competition between the Edison Company and the Cosmopolitan Electric Company is getting sharp in the 22d district. The "Record" says: "Agents of each concern are canvassing the list of consumers of its rival, and rates are cut freely. The Edison representatives are offering long-term contracts at liberal discounts from their usual monthly rates as an inducement to consumers, while the Cosmopolitan interests advise customers that electric light will be less expensive than terms now offered before the fight is much older."

Fredericksburg, Va.—D. F. Franklin Stakes, electrical engineer of the Fort Wayne Electrical Corporation, is here drawing plans and making estimates for a new electric light plant for the city.

Grand Rapids, Mich.—The board of public works has approved the specifications prepared for the public lighting plant and the secretary has been instructed to advertise for bids. The bids will be opened by the board September 20. The new specifications cover a wide range and are so framed that any firm having any sort or kind of electrical appliances to sell can bid on the same. Bids will be received for the direct connected system as in the old specifications and for the belted system. Bids will also be received for a complete plant, including the power house, arranged according to the idea of the individual bidder.

Kansas City, Mo.—D. S. Patterson, John Georgen and Fred P. Morrill have made the following proposition to the mayor and council of this city: "That a company to be organized by them and their associates will erect an electric light plant, and at the end of fifteen years will give the same to the city upon the following conditions: First—The city is to agree to appropriate $80,000 annually for fifteen years, pay to the company erecting the plant $68,000 annually, place the balance of $12,000 in a sinking fund each year to be invested in United States bonds, interest on the bonds to be reinvested in the same way. Second—The company will agree to furnish the city 1,000 arc lights suitably distributed over the city and keep them lighted on what

is known as the all-night schedule, each and every night. Third—At the expiration of the fifteen years the city is to turn over to the company the sinking fund and the company is to deed the plant to the city free of all incumbrances and in good condition."

London, Ont.—The power house of the London General Electric Company was burned on the night of the 29th ult., and the plant is a total wreck. The loss is about $25,000, fully insured.

New Richmond, O.—The citizens of this place are agitating the question of putting in an electric light plant and waterworks, and a special election will be held September 12 to vote on the proposition. There is some opposition to the matter, but it is believed that the proposition will carry.

New York.—Chief Engineer Daniel Ulrich has sent a report to the commissioner of parks in the Borough of the Bronx in which he recommends that the roads and parkways in that borough, and particularly the thoroughfares in the vicinity of Pelham Bay Park, be lighted by electric lamps.

Oakland, Md.—The town council proposes to buy the electric lighting plant of D. E. Offutt, if he will sell it for $13,000, and to issue bonds to provide for the purchase.

West Superior, Wis.—The council has voted to accept the proposition of William Burgess for furnishing street lighting to the city and a franchise will be prepared embodying the conditions. The following are the prices to be inserted in the contract, the term of which is five years: 150 arc lamps, 1,200 candle power, $75; 200 arc lamps, 1,200 candle power, $75; 300 arc lamps, 1,200 candle power, $72.50; all lamps over 300, $70; 150 arc lamps, 2,000 candle power, $80; 200 arc lamps, 2,000 candle power, $80; all lamps over 200 and under 300, $77.50; over 300, $75. Mr. Burgess has deposited a check for $500 as a guarantee of good faith and will file a bond for $10,000 upon the passage of the franchise for the performance of his agreement.

Wichita Falls, Tex.—J. B. Quigley of Sedalia, Mo., will probably be given a contract for the erection of waterworks and an electric light plant in this city.

MANUFACTURING, ETC.

Mexico.—The Municipal Council of the City of Mexico has granted permission to the Societe de San Ildefonso to erect overhead conductors in the public streets in connection with the plant it is putting down to supply electrical energy for power purposes.

New York.—Cuba and Porto Rico are attracting the attention of our large electrical manufacturing concerns as a promising market for their goods. An official of one of the local companies is reported in the "Commercial" as saying "that the rival concerns are busy studying the ground, with a view to sending their experts to the various cities where up-to date appliances are needed. The country is practically open to the modern ideas in use here, and there will be a great sale of American electrical goods as soon as the question of the ownership of the islands is settled. There will be electrical railroads in place of the antediluvian methods of transportation in use there now; ancient machinery in the workshops will give place to the newest of electrical equipments, and the waterways of the country will be used as motive power for plantation and city plants."

Washington, D. C.—The Treasury Department has directed Collector Bidwell to appeal from the decision of the Board of General Appraisers in assessing carbon sticks for electric lighting at 35 per cent. ad valorem. The department holds that the carbons are subject to duty at 90 cents a hundred, the rate originally fixed. —The Navy Department, through the Bureau of Yards and Docks, is inviting sealed proposals until September 24, for installing an electric light and power plant at the United States Navy Yard at Pensacola, Fla. Specifications and blank forms of proposals will be forwarded upon application to the Commandant of the Navy Yard at Pensacola, or to the Bureau of Yards and Docks, Washington, D. C.

TRANSMISSION PLANTS.

Budapest, Aus.-Hun.—A German firm lately obtained a concession from the Servian Government to exploit the water power of the Danube at the Iron Gates by establishing different industrial concerns to be worked by electricity. Work had hardly been started, however, when the Hungarian Government stopped it, declaring that Servia had no exclusive claim on the water power, and that an International Commission must decide to what degree each of the two countries might make use of it.

Denver, Col.—A correspondent of the "Times" writing from Ophir Loop, San Miguel County, Col., gives the following description of the plant of the Telluride Transmission Power Company at that place: "In the delta of the Rio and San Miguel, a short distance below the Loop, is located this great plant of which L. L. Nunn is the general manager. Two great dynamos stand up there nine feet high, two phase alternating current, 1,200 amperes each, step-up transformers to 10,000 volts on the line. The lake affords 1,200 horse power and the Howard branch 750. The transformers are six 100 KW. each, and two 375 KW. each. Water is conveyed to the plant from Trout Lake, a distance of over three miles, by flume and pipe line, with a fall of 901 feet, 436 pounds pressure to the square inch, in a fifteen-inch pipe at the plant. Its velocity is 14,520 feet per minute. The Howard fork line is about one mile in length, fall 550 feet, a pressure of 250 pounds, in a pipe fifteen inches at the plant. The current is transmitted to the great Tom Boy mine and mill in Savage basin, for power and light, a distance of about eighteen miles; the Columbia-Menona mine and mill in the same basin, Valleyview, Smuggler-Union in Marshall basin, the great 120 stamp mill on Bear creek; Gold King mine and mill, power for foundry and machine shops in Telluride, and lights for the towns of Telluride, Ophir, Trout Lake, Butterfly Mill and other points. The system is going out all over this rugged region, wherever a substantial business enterprise is planted or a town rounds into form. The dynamos weigh eighteen and one-half tons each. They are Westinghouse machines, and Mr. Nunn is adding all the valuable modern improvements to the plant as fast as they can be introduced. He is at the head of a plant similar to this one in Provo, Utah, a smaller one in Logan, that State, and his fertile brain is hatching half a dozen others, some of them stupendous in capacity."

Grand Rapids, Mich.—A company composed of New York capitalists has applied for a franchise to erect poles and wires here for an electrical transmission plant. The plan is to rebuild and improve the dam in the Muskegon river at Newaygo, where it is expected that from 1,200 to 1,500 horse power can be secured for conversion into electricity, which will be wired to this city and sold for manufacturing and lighting purposes. It is expected by the promoters that in time a number of other streams will be developed and the power sent to this city over the Newaygo-Grand Rapids wire. It is said that there are four or five streams within the same number of miles from Newaygo, from each of which a power of from 800 to 1,000 horse power could be secured.

Seattle, Wash.—The transmission line of the Snoqualmie Falls Power Company will consist of four circuits of three wires each; two circuits will supply Tacoma and two Seattle. There are two distinct pole lines. The poles are of cedar and the wires aluminum, and are run side by side from the falls for 19 miles to Renton, where they diverge, one going to Seattle and the other to Tacoma. The length of the pole line from the falls to Seattle is about 30 miles, and to Tacoma about 44 miles. The line runs through an almost unbroken forest of fir. A strip 25 feet wide has been cleared of all vegetation, and every tree within 300 feet on each side which could possibly strike the wires has been cut down, so that danger from forest fires or windfalls has been avoided. Aside from the exceptionally high voltage to be employed, the transmission line will be of great interest, from the fact that aluminum conductors will be used, and the plant will thus be the first in the world to use aluminum to transmit electricity to any distance. The wire to be used on the line contains all but 1½ per cent. of pure aluminum, the small percentage being copper. The aluminum wire while having only about 60 per cent. of the conductivity of copper was selected because of its extremely light weight, something to be taken into consideration in wire for long transmission.

MINES, ETC.

Indiana, Pa.—The "Gazette" states that it has been given out from a responsible source that the Glenwood Coal Company, at Glen Campbell, will soon commence the erection of a mammoth electric power house at Mine No. 6 which will furnish electricity for all three mines at Glen Campbell now in operation and also the new mines which will be opened on Brady Run. The electricity will be used to light the mines and haul the trains of mining cars in and out of the various mines. It is also stated that the company contemplates placing another dynamo for the purpose of furnishing light for the town.

COMPANY MATTERS.

Council Bluffs, Ia.—J. A. Patton has been appointed receiver of the Council Bluffs Gas & Electric Light Company, and will take charge of the plant pending the settlement of its affairs in the United States Circuit Court and its transfer to the bondholders.

PERSONAL AND MISCELLANEA.

Oscar Wright, superintendent of the Rockville Electric Light Company, died of typhoid fever at Rockville, Ind., on the 29th ult.

James Adams, president of the Western New York & Pennsylvania Railroad, and president of the Brush Electric Light Company, died in New York on the 2d inst.

John B. Dyar, a well-known capitalist and business man of Detroit, died last week at his summer home in Grosse Pointe. Mr. Dyar suffered some financial reverses a short time ago, alleged to have been caused by an electric road he projected from Detroit to Port Huron. Up to the time he met his reverses Mr. Dyar was a director of the Commercial National Bank, Detroit, and president of the Michigan Radiator & Manufacturing Company.

Electric train lighting has been introduced in Great Britain, more than twenty companies having agreed to adopt a uniform system, which, by the way, is radically different from that in use on American railways. Small dynamos are placed upon one of the axles of each railway car, the rotation of the axle furnishing the power for the light plant in each carriage. When the speed of the train is slower than 12 miles per hour the dynamos are automatically cut off, and in the meantime the supply of electricity for the lights is furnished by an auxiliary storage battery. The cost of installation for each car amounts to about $250, and the cost of maintenance is nominal.

The Altoona, Pa., "Gazette" states that the Pennsylvania Railroad Company has just completed in Altoona "one of the finest motive power and instruction cars ever turned out by any railroad. It is 60 feet in length, 50 feet being devoted to the office and examination room and the remaining 10 feet is utilized by a Baker heater and lavatory. The car is equipped with all the latest improvements in working airbrakes, triple brake valves, and in fact everything needed to thoroughly instruct engineers and firemen in the use of all the latest appliances. The car will soon be sent out on this division, and the men hauling the various freight and passenger trains will be taken into the car and there shown all the innovations which are likely to be made and with which they are expected to familiarize themselves."

The Toronto "Mail-Empire" says: "Mr. C. E. Green, who comes from Rochester, N. Y., but who has spent several years in Toronto, claims to have discovered a mode of producing electricity for light, heat and power purposes without either fuel or water. He declares that he can produce unlimited quantities right here in Toronto at a cost to consumers far below one-half that at present involved in the production of electrical energy. The secret of this miracle-working is, he says, a very simple affair, but he does not propose to give any clue to it just now. In a few weeks he trusts he will be able to place the scheme on a working basis."

Electrician W. W. Smith, of New Haven, Conn., is the inventor of an electrical apparatus designed for the use of physicians and dentists which is to give a new manufacturing enterprise to New Haven, arrangements having been made with the Elm City Brass Company of that city to manufacture the device. The apparatus as described in the New Haven "Register" "gives galvanic and faradic current which can be used separately or combined. It is especially valuable in cautery as the current can be raised or lowered without a break or impulse, which is something that has not been accomplished before. With the apparatus it is possible to raise or lower the voltage without a break in the circuit. There is no shock to the patient, which in itself is very important. The force may be increased gradually and when the operator is at work on delicate parts there is no nervous excitement occasioned by the higher pressure as might be by jumps and violent pressure. The apparatus is provided with a lamp which will be found useful in examining the throats of patients. The dental machine is designed for the use of dentists in their work where electricity is required. In fact the whole machine is intended to serve physicians and dentists in everything they have to do where electricity plays a part and in this electrical age these uses are many. The whole apparatus is placed in a handsome cabinet, which when closed looks like a small desk."

COMMERCIAL PARAGRAPHS.

While Iron and Steel Armored Conduit is being used to the exclusion of almost everything else in new conduit work, there is nevertheless a great deal of work where iron armored conduit cannot be used. The most satisfactory substitute under such circumstances is Canvasite Flexible Conduit. This is particularly useful in wiring or rewiring old buildings. The Electric Appliance Company, Chicago, are carrying Canvasite Flexible Conduit in all sizes from ¼ inch to 1¼ inch, and find that it has a ready sale for the above mentioned uses.

INCORPORATIONS.

The Electrical Export Company, New York—to deal in electrical goods. Capital stock, $20,000.

The Loveland Power & Electric Light Company, Loveland, O. Capital stock, $10,000.

The John Kammer Company, Chicago, Ill.—to manufacture electrical appliances. Capital stock, $50,000.

The Wisconsin Electric Storage & Water Company, Plymouth, Wis. Capital stock, $25,000.

The Northern Traction Company, Michigan City, Ind.—to build an electric railway from Michigan City to Laporte. Capital stock, $150,000.

The Gainesville Park Street Railway Company, Gainesville, Tex.—Capital stock, $100,000. Incorporators: J. M. Lindsay, George Lindsay and H. E. Eldridge.

The Wall & Cortlandt Street Ferries Railway Company, New York. Capital stock, $1,000,000. Directors: F. D. Moffat, Charles Base, K. S. Hogg, E. L. Conant, H. W. Beau, M. E. Gill and J. P. Sheffield, all of New York.

The Standard Light, Heat & Power Company, Unadilla, N. Y.—to furnish electricity for the villages of Unadilla, Gilbertsville and Otego, Otsego County; Sidney and Franklin, Delaware County, and Bainbrige and Alton, Chenango County. Capital stock, $60,000. Directors: Henry G. Canfield, Samuel E. North, J. Fred Sands and Daniel R. Buckley, all of Unadilla.

The Los Angeles Machinery Company, Los Angeles, Cal.—to buy, sell, exchange and manufacture all kinds of machinery and electrical plants. Capital stock, $10,000. Directors: R. E. Williams, Walter Jones, E. N. Williams, Theo. E. Eisen and C. Leonardt, all of Los Angeles.

The American Industrial & Commercial Union, Newark, N. J.—"to aid in organizing, managing and promoting co-operating companies for conducting legitimate and useful industrial business in any line, and to provide capi-

tal to enable them to carry on their business free from the embarrassments and perils of current indebtedness." Capital stock, $1,000,000. Incorporators: Maurice L. Muhleman, New York; Jacob F. Wycoff, Elizabeth, N. J., and Charles Vernon Culver, Reno, Pa.

The Jefferson Electric Light Company, Chicago, Ill.—to operate electric light and power plant. Capital stock, $50,000. Incorporators: M. A. Foot, Harry Ferguson, William M. Copeland.

The American Chemical & Electrical Manufacturing Company, Denver, Col.—to conduct a factory in Denver for the making of lampblack, coke, ammonia, tar, carbons and articles of a like character. Capital stock, $1,000. Directors: Mayer Harrison, Isaac Schuff and N. Burton.

The Buffalo, Tonawanda & Niagara Falls Electric Railway Company, Buffalo, N. Y. Capital stock, $1,250 000. Directors: Henry B. Smith and Hezekiah M. Gullett, Bay City, Mich.; Timothy E. Ellsworth, Lockport; James A. Roberts, George Sandrock and Clarence M. Howard, Buffalo; Benjamin L. Rand and John A. Read, North Tonawanda. Among the stockholders are John Cunneen, Michael Nellany, Dr. E. T. Smith, Gen. Benjamin Flagler, Judge E. W. Hatch, County Treasurer John C. Lammerts, Spencer J. Lawrence, Max Amberg, Frank S. Oakes, Ossian Bedell and George P. Smith.

ELECTRICAL PATENT RECORD.

Letters Patent Issued August 30, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

609,851. Electric Locomotion. Henry Van Hoevenbergh, New York City, assignor to Noah C. Rogers, same place. Filed Oct. 10, 1895. Renewed June 23, 1898.

609,977. Electric Railway-Motor. Albert Schmid, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company, same place. Filed May 10, 1894.

610,004. Rail Bond. William H. Talley, Waco, Tex., assignor, by direct and mesne assignments of nine-tenths to George H. Williams, Charles B. Eames and C. R. Sherrill, same place. Filed Nov. 26, 1897.

610,007. Contact Device for Electric Railways. Louis E. Walkins, Springfield, Mass., assignor of two-thirds to Francke W. Dickinson, same place, and George M. Jewett, Glenville, Md. Filed Jan. 24, 1898.

610,008. Contact-Rail Appliance for Electric Railways. Louis E. Walkins, Springfield, Mass., assignor to George M. Jewett, Glenville, Md., and Charles N. King, Jersey City, N. J. Filed Feb. 2, 1898.

610,009. Electric Railway. Louis E. Walkins, Springfield, Mass., assignor of one-half to George M. Jewett, Glenville, Md. Filed Feb. 2, 1898.

610,090. Electric Railroad. Benjamin C. Seaton, St. Louis, Mo., assignor to the Electric Third Rail & Signal Company, same place. Filed April 5, 1897.

610,091. Third Rail for Electric Railways. Benjamin C. Seaton, St. Louis, Mo., assignor to the Electric Third Rail & Signal Company, same place. Filed Dec. 7, 1897.

610,092. Contact Device for Electric Railways. Benjamin C. Seaton, St. Louis, Mo., assignor to the Electric Third Rail & Signal Company, same place. Filed Feb. 4, 1898.

610,093. Third Rail for Electric Railways. Benjamin C. Seaton, St. Louis, Mo., assignor to the Electric Third Rail & Signal Company, same place. Filed Feb. 4, 1898.

610,094. Electric Railway. Benjamin C. Seaton, St. Louis, Mo., assignor to the Electric Third Rail & Signal Company, same place. Filed Feb. 18, 1898.

609,818. Car-Fender. Prentis E. Law, Wilmette, Ill. Filed Oct. 14, 1897.

609,951. Car Fender. Andrew L. Smith, New York City. Filed Aug. 19, 1896.

ELECTRIC LIGHTS AND APPLIANCES.

609,924. Incandescent-Lamp Shade or Cover. Wallace H. Wells, Brasher Falls, N. Y. Filed March 28, 1898.

609,972. Hanger for Electric Lamps. William F. Murphy, Iowa City, Iowa. Filed Dec. 21, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

609,990. Means for Controlling Non-Synchronous Alternating Current Motors. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company, same place. Filed March 11, 1896.

609,991. Method of and Means for Securing Constant Torque in Polyphase Motors. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Feb. 10, 1898.

610,016. Electric Switch. Rollin A. Baldwin, South Norwalk, Conn., assignor of one-half to Heavlon Rowland, same place. Filed March 25, 1897.

610,023. Automatic Cut-Out for Magneto-Generators. William J. Bowen and Charles A. Federer, Cleveland, O., assignors to Louis Sands, same place. Filed May 26, 1898.

610,025. Alternating-Current Motor. Charles S. Bradley, Avon, N. Y. Filed Sept. 17, 1897.

610,067. Induction-Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed July 22, 1897.

610,121. Controller for Electric Motors. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed April 25, 1898.

TELEPHONE AND TELEGRAPH APPARATUS.

609,877. Tension-Regulator for Electrical Transmission of Speech. Alfred C. Cousens, Newark, N. J., assignor of one-half to George W. Gregory and John C. Edwards, Boston, Mass. Filed June 15, 1895.

MISCELLANEOUS.

609,875. Electrode for Medical Purposes. Marian N. Clarke, Wilkes Barre, Pa. Filed Jan. 8, 1898.

609,888. Clamp for Electric Wires. Sylvester S. Leonard, Chicago, Ill. Filed Jan. 24, 1898.

RE-ISSUE.

11,689. Electric-Circuit Controller. Joseph H. Bowley, Washington, D. C., assignor of one-half to John W. Stockwell, Marengo, Ill. Filed March 19, 1898. Original No. 593,510 dated Nov. 9, 1897.

TELEPHONE AND TELEGRAPH.

The Erie Telephone Company Absorbs Opposition Lines in Minnesota.

The following appears in the Boston *News Bureau* of the 2d inst.:

"The independent telephone companies in Minnesota have during the past three years constructed a system of long distance lines connecting points not reached by the Northwestern Telephone system operating in that State. Notwithstanding the fact that the Northwestern system owned and operated 7,000 miles of wire, the independents had built to nearly 300 points not reached by the Northwestern, using fully 2,200 miles of wire. Yesterday the Northwestern Company closed a contract whereby it secures by purchase 900 miles of this line and enters into an operating arrangement with the balance, all of which are to be equipped with Bell instruments and the lines and stations become a part of the extensive Northwestern system controlled by the Erie Telephone Company. The result of the purchase and agreements increases the Northwestern toll line system to nearly 10,000 miles, and as soon as the new lines can be equipped with Bell instruments, 800 stations will be to the general system. The arrangement added saves the Northwestern Company an expenditure of $200,000, representing the cost of lines into a territory already developed, and gives Minnesota the most complete long distance telephone system in the United States to date. The lines acquired that are single grounded circuits, the Northwestern will make metallic. This transaction gives to the Northwestern Company the entire toll line system in Minnesota."

The Washington *Star* says: "The War Department has received advices from Porto Rico on the work being done by the little army of Signal Service men on the island. There are 300 of these men now there and they will have to assume the control and operation of the Government lines of telegraph. The lines now, of course, are operated by the Spaniards, but when the possession of the island is transferred to the United States the Signal Service will have to take charge until the future status of the system is determined. This Government always has been opposed to a Government telegraph system and Signal Service officials say it is not improbable that the lines in the new island possession will be eventually sold to private enterprise through bids for its purchase. This, however, has not yet been taken up officially and Government control will have to be assumed at least until the ultimate disposition is determined at all the offices on the entire telegraph system of Porto Rico."

At Freeport, L. I., at the first annual meeting of the stockholders of the South Shore Telephone Company, the following directors were elected for the ensuing year: John J. Randall, George W. Bergen, William G. Miller, William D. Carter, Charles D. Smith, George P. Bergen and Henry P. Libby. The president's statement showed the business of the company to be rapidly increasing, a large number of telephones having been added to the service during the past month, and the lines having been extended to Garden City and Mineola. The statement also showed the company to be in excellent financial standing. The company's service has been introduced into the villages of Freeport, Baldwins, Rockville Center, Lynbrook, Oceanside, East Rockaway, Hempstead, Garden City, Mineola, Merrick and Barnum Island.

Extensive preparations are being made by a Franco-German syndicate to establish a telephone line from Paris to Berlin. For several months serious negotiations have been taking place between these two cities, and Brussels also, to unite the three capitals by telephone. The undertaking is silently viewed in Berlin, but arouses more or less disparaging remarks in Paris, where it is said that the scheme is entirely unnecessary. Brussels will be, of course, the medium of communication. The syndicate officers in Paris assure the public that a double wire will be used and that every precaution will be taken to provide rapid and regular service. The wires are a composition of bronze and tin, and will have a diameter of five millimeters. It is said that with this wire the resistance to the electrical current will be greatly reduced. When completed the line will be 1,000 kilometers in length, without any retransmission station, and will hence be the longest in Europe.

A special to the Little Rock *Gazette* from Camden, Ark., states that the Camden Telephone Company, established several years ago, has decided to discard their old equipments and will use the telephone switchboards and other equipments of the Southwestern Telephone Company and will act as the agents of that company at Camden for its long distance lines.

The franchise of the Osawatomie Telephone Company has been assigned to the Paola Telephone Company of Paola, Kan., and the exchanges of the two towns are now under one management.

Electrical Storms.

In the western part of Kansas wind storms occasionally sweep over the country producing electrical effects which are so pronounced that the plainsmen have named them electrical storms. T. B. Jennings of the Kansas Climate and Crop Service gives this description of them: "The wind blows with great force. It rapidly generates electricity in the person exposed to it and electrical sparks will pass from his hands to any metal he may chance to approach. The housewife has to wrap up her hands in rags as she handles her stove, or the current will play around them embarrassingly. As the sheets of a bed are touched by the hand there will be a brilliant glow of electric luminosity, and the bed clothes will fairly crackle as they are moved to and fro. These conditions are not uniform, but run in currents or streaks, and vary greatly even in the same district. The winds are mostly from the northwest. Growing grain and foliage on trees exposed to them become more or less scorched, and sometimes the grain crop is entirely destroyed. These phenomena are observed in other parts of the country, but particularly in the mountains of Colorado, where they are usually attendant on the severe blowing of the west wind. The air may be either quite dry or filled with the finest forms of vapor condensation; but nothing seems to interfere with the steady stream of electrical discharge which flows from every sharp point, whether rock, or plant, or dwelling place. A tingling and cooling sensation is felt, similar to that experienced by patients in taking the electrical bath treatment, and the multitude of discharges going on all around fill the air with a singing sound. The operators at the meteorological station at Pike's Peak experience these demonstrations in such a pronounced form that they would often be seriously alarmed were they not sensible of the comparative absence of danger. The accumulations of electric current will take the guise of flashes and balls of lightning, and the iron stove will be ablaze with continuous electrical discharges. The origin of the electricity of such storms is not yet satisfactorily explained."

The report of the Committee of the New Zealand Legislature, just issued, recommends joining the Australian Colonies with Canada and the mother country by a Pacific cable, on the basis that if Great Britain and Canada together would guarantee five-ninths of the cost of the work, New Zealand and the other Colonies would contribute the remaining four-ninths, of which amount New Zealand will contribute one-ninth. The committee also recommends that Canada be furnished with the construction, administration and maintenance of the cable, on the understanding that the contributing Colonies are to be entitled to representation and votes on matters of policy of the management and that the cable is to be owned jointly and controlled by the contributors. The report concludes with advising that a conference of the Colonies concerned be held in New Zealand.

Alex. I. McLeod of the Detroit Telephone Company says there is no connection between his company and the new company that has been formed in Cleveland, with a capital stock of $1,000,000, to build cheap telephone and telegraph lines in Cleveland and all over the State of Ohio. To a Detroit *Tribune* reporter Mr. McLeod said: "H. A. Everett, the leader in that enterprise, is a stockholder in our company and at one time was a director. The Cleveland company is going to be a strong organization and our construction company expects to sell them a large part of their equipment. The 'phone they will use is practically the same as ours."

At a meeting of the directors of the Pacific Cable Company, held at the office of J. P. Morgan & Co., New York, on the 1st inst., plans were considered for establishing cable communication with the Philippines, the Asiatic coast, Japan and Australasia via Hawaii. Surveys for a duplicate cable via Sitka and the Aleutian Islands were ordered. James A. Scrymser, president of the Pacific Cable Company, sails from Vancouver for Japan on September 12.

The statement of the output of instruments by the American Bell Telephone Company for the month ended August 20 shows: Gross output, 24,863, increase over same month in 1897, 9,096; returned, 12,022, increase 1,868; net output, 12,841, increase 7,228. From December 21 to August 20: Gross output, 212,747, increase 69,202; returned, 95,328, increase 33 327; net output, 117,419, increase 35,875. Total output August 20, 1898: 1,036,541; August 20, 1897, 851,171; increase, 182,370.

New Companies Incorporated.

The Gordon Telephone Company, Chester, Ill. Capital stock, $5,000. Incorporators: A. G. Gordon, E. R. Gordon and Clarice Gordon.

The Dakota Central Telephone Company, Aberdeen, S. D. Capital stock, $100,000. Incorporators: W. G. Bickeyhaupt, M. H. Zeitlow and L. W. Crofoot.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N Y.—Sept 6:						
Albany Ry. Co.	100	2,000,000	$1,750,000	1¾ % Q., Feb. '98.	146¾	150
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	69	70
Traction Co. (Saratoga)	100	50,000	50,000	....	..	..
Allentown Pa.—Sept 6:						
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Sept 6:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	89	..
Baltimore, Md.—Sept 6:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	71	72
aBaltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	3 % S., Jan. 15, '98.	28⅝	28¾
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—Sept 6:						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	...	..
North Shore Traction Co. com.	100	4,000,000	4,000,000	....	10¼	12
North Shore Traction Co. pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	76¼	78
b West End Street Ry. Co. com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	86½	81¼
b West End Street Ry. Co. 8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	105	106
Boston Elevated R. R.	100	10,000,000			68¼	..
Brooklyn N. Y.—Sept 6:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certif.	100	20,000,000	20,000,000	....	64⅛	64¾
cBrooklyn Heights Railroad		200,000	200,000	....	..	..
*dBrooklyn City RR. guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	214¾	215¾
eBrooklyn, Queens Co. & Sub. RR.		2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	208	..
Kings County Elevated		4,750,000	4,750,000	....	6	8
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	..	40
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Sept 6:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	....	67	68
*Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q. Dec., '97.	79½	80
Columbus O.—Sept 6:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb., '98.	51	54
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Sept 6:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co.	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Sept 6:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	295	298
Chicago & South Side R. T. RR.	100	10,328,800	10,328,800	....	..	..
Lake Street Elevated RR.	100	10,000,000	10,000,000	....	18	18¼
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk.	100	15,000,000	15,000,000	....	..	..
North Chicago Street RR.	100	15,000,000	2,500,000	....	..	..
hNorth Chicago City RR.	100	10,000,000	6,600,000	3 % Q., Jan., 98.	224	226
South Chicago City Railway	100	500,000	249,900	....	..	..
iWest Chicago St. RR. Co.	100	2,000,000	1,608,200	....	..	..
jChicago West Div. Ry. guar.	100	20,000,000	13,189,000	1½ % Q., Feb. 98.	95	95½
kChicago Passenger Ry. guar.	100	1,250,000	624,900	35 %	..	..
	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Sept 6:						
Cincinnati Inc. Plane Ry. com.	50	1,000,000	575,000		..	20
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	50	4,000,000	3,500,000		23	25
lCincinnati Street Ry. Co.	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118	118¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1½ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Sept 6:						
Akron, Bed. & Clev. Elec. Ry.	100	1,000,000	1,000,000	¾ % Jan., '98	38	40
Cleveland City Ry.	100	8,000,000	7,600,000	¾ %., Oct., '97.	68	70
Cleveland Electric Ry.	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	70	71
Detroit, Mich.—Sept 6:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co.	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry.	100	250,000	200,000	....	100	110
Dayton O.—Sept 6:						
City Railway Co. com.	100	1,500,000	1,470,000	1¼ % Q., Jan.1, '98.	104	105
City Railway Co. pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	103

*Unlisted. †Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,-000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Sept 6:						
Hartford Street Ry. Co.	100	$4,000,000	$200,000	3 % S., Jan., '98.	140	..
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	..
Holyoke Mass.—Sept 6:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—Sept 6:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70	..
Indianapolis, Ind—Sept 6:						
**Citizens' Passenger Ry.	....	5,000,000	5,000,000	....	25	26
Lancaster, Pa.—Sept 6:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000	....	..	..
Lancaster & Col. Electric Ry.	....	....	87,500	....	..	..
West End Street Railway	....	....	....	....	..	..
Louisville, Ky.—Sept 6:						
Louisville Ry. com.	100	4,000,000	3,500,000	1½ %., Oct., '97.	37	38
Louisville Ry. 5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	101	102
Minneapolis, Minn.—Sept 6:						
Twin City Rapid Transit com.	100	17,000,000	15,010,000	....	25	..
Twin City Rapid Transit 7 % pfd.	....	3,000,000	1,714,200	1¾ %, Jan., '98.	101	102
Montreal, Canada.—Sept 6:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	278½	279
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1¾ % S., J. & J.	101½	102¼
Memphis, Tenn.—Sept 6:						
Memphis Street Railway Co.	100	500,000	500,000	....	15	..
New Haven, Conn.—Sept 6:						
Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co.	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000		..	..
Winchester Avenue RR.	25	1,000,000	600,000		40	42
New Orleans, La.—Sept 6:						
Canal & Claiborne RR. Co.	40	240,000	240,000	4 % S., Jan., '98.	150	180
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	124
New Orleans Traction Co. com.	100	5,000,000	5,000,000	....	1	2
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000	....	6	8
aCrescent City RR. guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	28¾
bNew Or. City & Lake RR. guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23	26
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	52½	55
New York—Sept 6:						
Central Crosstown RR.	100	600,000	600,000	2½ % Q., July, '97.	255	..
cChristopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Jan., '98.	160	..
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98.	170	195
dMetropolitan Street Ry. Co.	100	30,000,000	30,000,000	1½ % Q., Jan., 98.	153	153⅝
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	34	36
fBroadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	212	220
gCen. Park, N.&E. Rivers RR. guar	100	1,800,000	1,800,000	2½ % Q., Jan, '98.	177	185
hEighth Avenue RR.	100	1,000,000	1,000,000	....	350	..
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q., Feb., '98.	340	360
jNinth Avenue RR. guar.	100	800,000	800,000	....	183	193
kSixth Avenue RR. guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co. guar.	100	600,000	600,000	4½ % Q. Feb., '98.	310	..
Second Avenue RR.	100	2,500,000	1,862,000	2 % Q., Jan., '98.	176	180
Third Avenue RR.	100	12,000,000	10,000,000	2 % Q., Feb., '98.	175	180
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	60	64
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Sept 6:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	51	52
Newark Passenger Ry.	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry.	100	504,000	504,000	1½ % A.	195	205
Pittsburg, Pa.—Sept 6:						
Allegheny Traction Co.	50	500,000	500,000	....	..	..
oConsolidated Traction Co. com.	50	15,000,000	15,000,000	2 %, Jan., '96.	17⅞	18
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	3 %, May, '97.	55½	56⅛
pCentral Traction Co.	50	1,500,000	900,000	....	..	...
qCitizens' Traction Co.	50	3,000,000	‡3,000,000	6 % A.	63	...
rDuquesne Traction Co.	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co.	50	2,500,000	1,900,000	3 %, Aug., '95.	..	...
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	..
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	‖2,994,889	2 %, Aug., '95.	..	...
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	21¾	..
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 97.	..	...
Second Avenue Traction Co. com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co.	50	300,000	200,000	....	..	..

*Unlisted. ‡Full paid. ‖Outstanding. †Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Sept 6						
Union Street Railway Co	100	$350,000	$350,000	2 %, Feb. '98.	...	150
Northampton, Mass—Sept 6						
Northampton Street Ry	100	300,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Sept 6:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Sept 6:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Sept 6:						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	70	70½
Philadelphia.—Sept 6:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98.	67½	..
a Fairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3 % Feb. 1, '98.	65½	66
Union Traction Co..... $12½ pd	50	30,000,000	29,930,450	....	21	...
c Electric Traction Co	50	....	8,297,920	....	71¾	71½
d Citizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	315	..
e Frankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha's A—Apr.98	392	..
f Lehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
f Lombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
d Second & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	263	...
c People's Traction Co	50	10,000,000	†6,000,000	8 %, A., April, '98.	...	..
g Germantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	185	186
g Green & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	186	..
h People's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
h People's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
i Philadelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	93¼	..
j Catherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
j Continental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	136½	..
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
j Philadelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	175	180
j Philadelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	88	..
j Ridge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	288	300
j Philadelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j 17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July, '98.	157½	..
j Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	275	...
j Union Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
j West Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.—Sept 6:						
Rochester Railway Co	100	5,000,000	5,000,000	....	12	15
Reading, Pa.—Sept 6:						
j Reading Traction Co	..	1,000,000	1,000,000	Semi-an.,Jan. & Jy	15	20
k City Passenger Ry	50	350,000	350,000	Jan., '98.	114	...
l East Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Sept 6:						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % July,'98.	127	129
National Railway Co	..	2,500,000	2,479,000	1½ %, July,'98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR.	100	2,000,000	1,500,000	4 %, Oct., '98.	90	110
St. Louis RR.	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR.	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry.....com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	110	112
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	58	55
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Aug.						
California St. Cable RR.	100	1,000,000	600,000	50c. monthly.	106	107¾
Geary Street Park & Ocean RR.	100	1,000,000	375,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅞	54¼
Presidio & Ferries RR.	100	1,000,000	550,000	....	8⅛	8½
Scranton, Pa—Sept 6:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
m Scranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
m Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Sept 6:						
Springfield Consolidated Ry	100	750,000	750,000	....	....	11
Springfield O.—Sept 6:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—Sept 6:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—Sept 6:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	101⅞	102⅛
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	278⅜	279
Washington, D. C.—Sept 6:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	73½	74
Columbia Ry. Co	50	400,000	400,000	6 % A.	..	75
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	122	128
Worcester, Mass.—Sept 6:						
*Worcester Traction Co.......com.	100	3,000,000	3,000,000	....	15½	17
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	8 % S., Feb., '98.	94	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Sept 6:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the [illegible]

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Sept 6:						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., July, '98.	280	282
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	73½	75
New England Telephone Co	..	10,894,600	10,894,600	$1.50 %, Feb. '98.	143	..
New York.—Sept 6:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	96	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q	107	109
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	170	...
Franklin Teleg. Co.....2½ % guar.	100	1,000,000	......	1¼ % S.	40	...
Erie Telegraph & Telephone Co	100	5,020,000	4,800,000	1 % Q., Jan.., '98.	..	74½
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q	110	112
*International,Ocean Tel Co.guar6%	100	3,000,000	......	1½ % Q.	107	110
Mexican Telephone Co	100	2,000,000			..	.85
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	1½ % Q., Jan., '98.	149	151
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	92	..
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	113
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	91	94½
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Sept 6:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	160	170
Chesapeake & Potomac Telep. Co	100	......	......	....	47	55
Chicago Telephone Co	100	......	......	....	212	..
Central Dist Prtg & Telg.Co.(Pgh.)	100	750,000	750,000	....	123½	124
Empire & Bay States Telegraph Co.	...	......	......	....	72	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	76	77
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	112	115
Providence (R. I.) Teleph. Co	50	......	......	....	86	90
Southern New Eng. Teleph. Co	100	5,000,000	......	....	121	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Sept 6:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	..	..
General Electric Co.........com.	100	40,000,000	30,460,000	2 % Q., Aug., 1893.	45⅞	46
General Electric Co.........pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	98	100
T.-H. Elec. Co...T. Secur., Series D.	..	......	......	....	2½	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700		30½	32
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., July, '98.	57½	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Sept 6:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,988,000	....	181	184
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '97.	124	124½
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co		......	......	....	21	23
General Electric Co.........com.	100	40,000,000	30,460,000	2 % Q., Aug , 1893.	45⅞	46
General Electric Co.........pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	98	100
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co...pfd		......	......	....	..	..
Pittsburg, Pa.—Sept 6:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	130	140
East End Electric Light Co	50	300,000	300,000	Q	..	10
Philadelphia, Pa.—Sept 6:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	37¼	38
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	48	49½
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$82500 dis. Jan.11'97	13½	14
Southern Elec. Light & Power Co.	10	187,500	187,500	....	8	10
Miscellaneous.—Sept 6:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	33½	35
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	15
Eddy Electric Mfg. Co	25	......	......	....	....	15
Hartford (Conn.) Elec. Light Co	100	350,000	......	....	120	..
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	4½	10
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	175	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	83½	87
Rhode Island Elec. Protec. Co	100	......	......	....	110	120
Royal Elec. Co. (Montreal)	..	1,000,000	......	2½ Q	*163¼	164
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	187¼	188
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	100	110

*ex d.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authors'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Sept 6:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1,'98	35	37
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—Sept 6:						
Consolidated Electric Storage Co	...	......	....	....	18	20
Edison European	..	......	....	......	1	3
Safety Car Heating & Lighting Co.	100	......	....	......	100	105
Worthington Pump Co.......com.	100	5,500,000	5,500,000	......	21	23
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	90	93
Philadelphia, Pa.—Sept 6:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1	1½
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co.....com.	100	3,500,000	......	....	18	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	75	..
Welsbach Light Co	5	525,100	......	....	54	51½
Welsbach Light Co., Canada.	5	500,000	......	....	..	2¼
Pittsburg, Pa.—Sept 6:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	115	..
Miscellaneous.—Sept 6:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	..	16
*Barney & Smith Car Co ....pfd.	100	......	2,500,000	2 %	...	55
Billings & Spencer Co	25	......	......	....	80	87
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '93.	32½	37½
Johns-Pratt Co	100	......	......	....	98	100
*Pratt & Whitney Co..........com.	100	......	......	....	..	..
*Pratt & Whitney Co..........pfd	100	......	......	....	42	48
Stillwell-Bierce Co..........com.	..	......	......	....	96	98
Stillwell-Bierce Co..........pfd.	..	......	......	2 % Sept. 1, '97.	107	109
Shultz Belting Co	100	300,000	......	....	60	[illegible]
St. Charles Car Co	.	......	......	....	85	97

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Sept 6, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR. 1st mtg. 6s	350,000	350,000	1919	M. & N.	*118½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co...................1st 5s	....	....	......	......	*105	105½

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Sept 6, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113½	114
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	113½	114
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103⅛	104
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116⅛
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	102¼	102¾
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	116	117
City & Suburban Ry......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	114	......
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111	....
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	118	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	105
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	104	105
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	107	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	101¼	102¼
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T..............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	103½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	54	54¾
North Chicago St. RR..........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	105
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	104	104¼
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	104½	....
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	99¼	99⅞
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	94
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Sept 6, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	102	102½
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	107½	108
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108½
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‖So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	102	102½
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	100	102
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102	105
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s	600,000	600,000	1913	M. & S.	106	......
New Haven (Edgewood Div.) 1st mtg. 5s	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 5	100,000	94,000	1909	M. & S.	102	......

*With interest. *Unlisted.

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.......1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR.............1st mtg. 6s.	......	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	76⅛	79
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	107	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	103½	104¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	......
Orleans Railroad Co.......Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	105	110
‡St. Charles St. RR. Co.......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	......	....

†$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	108	......
‡Bro'dway & 7th Ave. 1st cons. mtg. 5s.	12,500,000	7,650,000	1943	J. & D.	120¼	......
Broadway & 7th Ave..........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	106	110
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	106	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	112	115
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	117
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR.......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	105¾	108
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	105¼	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	103	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111	118
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118¾	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	108
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	980,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5%.	1,100,000	1,100,000	1914	F. & A.	101	*102½
Eighth Av. RR. Co....Cert. indebt. 6%.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	118	116
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	90	95
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	122¾	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	113¾	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	108	110
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co..........1st mtg. 5s.	350,000	350,000	1919	......	113½	114
Third Avenue RR.........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124	125
Twenty-third Street Ry.........1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	103	....
Union (Huckleberry) Ry......1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111¾	112½

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.....................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation—Sept 6, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry........1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry...............1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901		....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s'	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry...............Cons. mtg. 5s'	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s.	5,698,210	....	1943		102	103
Phila. City Passenger Ry.......1st mtg. 5s.	200,000	200,000	1910	J & J.	....	....
Philadelphia Trac. Co.........Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry..............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...............Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	....
West End Passenger Ry.........1st mtg. 7s.	....	....	1905		....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry...........2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Sept 6, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......5s.	500,000	500,060	1931	M. & S.	90	......
Central Traction Co...............1st mtg. 5s.	375,000	375,000	1930	J. & J	....	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	118
*Duquesne Traction Co............1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108¼	....
*Fed'l St. & Pleas. Val. Jack's Run......5s.	50,000	50,000	1918	J. & J.	....	....
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	......
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	105¼	....
Pittsburg, Crafton & Mansfield............5s.	250,000	250,000	1924	J. & J.	....	....
Pittsburg Traction Co...............1st mtg. 5s.	750,000	750,000	1927	A. & O.	....	....
Pittsburg & Birmingham..........1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	....	103¾
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	....
Second Ave. Traction Co...................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation—Sept 6, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	100¼	101½
Cass Ave. & Fair Gds. Ry.......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	101½	102½
Citizens' Railway Co..........1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1913	J. & J.	111	112½

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Sept 6. 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	$50,000	$50,000	1908	J. & J.	80	85
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co........................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	106⅛	107⅛
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co..............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	108
People's RR. Co......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co.......................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97⅛	100
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100⅛	101⅛
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101⅛	102⅛
St. Louis & Sub. Ry...............Income 5s.	800,000	800,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	110⅛	111⅛
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102⅛	103½
Union Depot RR. Co.........Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	114⅛	115⅛
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation— Aug, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	113⅛	115
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	115⅛	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	93	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	126⅛	....
†Metropolitan Ry. Co..................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co..................1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127¼	128
†Park & Cliff House RR.........1st mtg. 6s.	850,000	850,000	1912	J. & J.	104⅛	105⅛
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	107	......
†Powell St. Ry........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118	120
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Sept 6, 1898.						
Belt Ry. Co.........................Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	....
Columbia Ry..............................1s mtg. 6s.	500,000	500,000	1914	A. & O.	120	125
Eckington & Soldiers' Home. 1st mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	121¾	......
†$50,000 in escrow to retire 1st mtg.bds.						
Miscellaneous.						
Date of Quotation—Sept 6. 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	104⅛	......
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	118	114
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	8,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	8,000,000	2,866,000	1932	M. & N.	110⅛	111⅛
¶Columbus (O.) St. Ry......1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	101⅛	102
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	18,965,000	1933	J. & D.	105	106
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	103
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	86
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	114⅛	115½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	91	92
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	8,000,000	2,878,000	1928	J. & J.	103	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108⅛
Rochester (N. Y.) Ry...........1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	98	99
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92⅛
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Sept 6, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	108	....
Pittsburg, Pa.						
Date of Quotation—Sept 6, 1898						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co.Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Sept 6, 1898.)						
Edison El. Ilg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	110	....
Edison El. Ilg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117¾	......
Edison Elec. Ilg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	....	......	....	......
Edison Ilg. Co. (St. Louis)..............	4,000,000	.....	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Sept 6. 1898.						
American Bell Telephone....................7s.			1898	F. & A.	101⅛	....
Northwestern Telegraph Co................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	....	106	......
Chesapeake & Potomac Teleph. Co....5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Sept 6, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co................	....	....	......	......	......	25
Barney & Smith Car Co...................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co......................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co......................	[illegible]	......	....	......	....	....
*Unlisted †Nominal						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12@12⅛c.; Lake, 12.15@12.25c.; casting, 11⅞@12c.

The Chicago Telephone Company has declared a dividend of 1 per cent., payable on and after September 6.

Stockholders of the Union Traction Company of Philadelphia will convene in annual meeting in that city on September 21.

The Philadelphia Traction Company has declared a semi-annual dividend of $2, payable October 1. Books close September 20 and reopen October 1.

The Brooklyn (N. Y.) Rapid Transit Railroad Company reports gross earnings for August of $563,257, an increase of $85,857 as compared with the same month last year.

The Chicago City Railway Company has declared a dividend of 3 per cent. on its capital stock, payable September 30. Books close September 16 and reopen September 21.

The North Shore Traction Company, Boston, has declared a semi-annual dividend of 3 per cent. on its preferred stock, payable by the Continental Trust Company of New York, transfer agent, on October 1. Transfer books close September 13 and reopen October 19.

It is shrewdly suggested by the Boston "Advertiser" that the market is controlled more by men than by figures. The knowledge that Morgan or Keene or Flower or Rockefeller is interested actively in any property is received with much more pleasure by the Street than any cold-blooded statement of earnings or expenses.

The United Electric Securities Company, Boston, has purchased of its collateral 5 per cent. bonds an amount sufficient to absorb $72,632 as follows: Fifth series, $10,000 at 100; seventh series, $3,000 at 99⅜; ninth series, $46,000 at 101.57; tenth series, $13,000 at 99.40. The annual meeting of the company will be held at Portland, Me., September 8. Books closed August 25 will reopen September 9.

The Buffalo (N. Y.) Railway Company reports for the year ended June 30: Gross earnings, $1,356,494, increase over 1897, $29,406; operating expenses, $678,135, increase $9,283; net earnings, $678,359, increase $20,123; other income, $28,779, increase $4,985; total income, $707,138, increase $25,108; fixed charges, $420,348, decrease $6,774; balance, $286,790, increase $31,883.

A mortgage of the Gloucester Electric Company, Gloucester, Mass., to the amount of $50,000 to the Old Colony Trust Company of Boston has been recorded in Salem. This mortgage is to raise money to pay bonds of the amount named. A mortgage of the Plum Island Street Railway Company of Newburyport to the amount of $33,000, to the International Trust Company, was also recorded in Salem. This is to secure money to pay bonds.

The Edison Electric Light Company of Brooklyn issued a circular to stockholders on the 31st ult. describing the manner of conversion to the Kings County Electric Light & Power Company. Edison stock is to be deposited with the Central Trust Company with power to them to transfer. After the receipt of two-thirds of the stock the Central Trust Company will assign it to the Kings County Company and receive the purchase money, which is to be held in trust as an absolute protection for the Edison Company's new securities.

The Farmers' Loan & Trust Company of New York has commenced suit in the United States Circuit Court, Omaha, Neb., against the Council Bluffs Gas & Electric Light Company, to foreclose the first mortgage of $250,000, payment of principal and interest of which it is alleged has been defaulted. The appointment of a receiver is asked for. Hon. George F. Wright, originally the principal stockholder of the Gas & Electric Light Company, is quoted as saying that the suit was for the purpose of allowing the Eastern stockholders who are reorganizing the company an opportunity to buy in the plant. When this is done the reorganized company will issue new bonds at a lower rate of interest.

The manipulators worked General Electric stock last week "for all it was worth," putting it up about 6 points by circulating rumors of equipment contracts, increased orders from abroad, etc. There was a rumor also that a settlement had been made with the preferred stockholders. The Boston "News Bureau" of the 1st inst., however, states that so far as the Boston interests in the matter are concerned no overtures to the preferred stockholders' committee have been made. The same paper had the following: "Private wire dispatches state that a bull pool has been formed in General Electric. There is talk of early electrical equipment of Manhattan, with good prospects of General Electric securing the contract. [The old game.] Price, McCormick & Co. were large buyers of the stock."

The report of the Street Railway & Illuminating Properties for the year ending July 31 furnishes the following: Securities from previous year, par, $5,157,955; decrease, $471,045. Securities received from other companies against adv., etc., $904,193; increase, $877,572. Total, $6,062,148; increase, $406,527. Par value securities sold, paid or disposed of, $1,838,158; increase, $1,340,492. Securities held by trust at par, $4,223,989; decrease, $933,966. Total, $6,062,148; increase, $406,527. The Street Railway & Illuminating Properties was formed on the basis of the General Electric Company's treasury assets to relieve it in a measure several years ago. We get this information from the N. Y "Journal of Commerce."

The Nassau Electric Railroad Company, Brooklyn, reports for the year ended June 30: Gross earnings, $2,054,080, increase over 1897 $293,518; operating expenses, $1,259,838, increase $214,474; net earnings, $794,242, increase $79,044; other income, $63,610, decrease $1,102; total income, $827,857, increase $77,942; fixed charges, $810,028, increase $100,718; surplus, $47,824, decrease $22,776; betterments, $388,428, decrease $697,661. The general balance sheet as of June 30 shows: Assets—Cost of road and equipment, $9,301,229; rights to use tracks of Kings County Electric Railway Company, et al., etc., $2,000,000; supplies on hand and materials, $26,759; additions and betterments, leased lines, $1,782,673; prepaid insurance, $25,558; open accounts, $44,077; cash on hand, $87,971; bills receivable, $22,000; total, $13,290,268 Liabilities—Capital stock, common, $6,000,000; preferred, $4,849,000; loans and bills payable, $1,804,655; interest due and accrued, $60,612; accounts payable, $131,629; accrued taxes, $84,754; rentals due and accrued, $184,913; profit and loss (surplus), $174,673; total, $13,290,268.

In regard to the change of motive power on the Third Avenue lines in New York, Edward Lauterbach, the counsel of the company, is quoted as saying: "The underground trolley which is to replace the cable and other traction methods of the company will be in operation in sixty days after the beginning of the work on the main Third Avenue line. Before the snow flies the cars of the Forty-second street line will be operated by electricity and those of the 125th street line in ninety days. The Dry Dock line will be left over until the spring. The change from cable to trolley will result in little, if any, interference with the operation of the Third Avenue system, except perhaps on the Forty-second street line. All the changes and improvements contemplated for the system will cost from twelve to fifteen million dollars. The new cars will be lighted by electricity, will be handsomely equipped and properly heated for the cold season. We are reaching out with the Union Railway Company and improving its service steadily, and our relations with the Metropolitan Street Railway Company continue to be pleasant. The change on Third avenue from cable to electricity was brought about by the force of sound logic and no considerations that involved delay were heeded."

ELECTRICITY.

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ELECTRICITY

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CONTENTS.

EDITORIAL NOTES.

The Electric Furnace. The electric furnace, as Prof. Trowbridge once aptly expressed it, has revolutionized certain processes in the arts. This is probably due to the fact that the electric furnace differs from other furnaces in that it localizes the heat in a narrow compass and thus an enormously high temperature can be obtained. As is well known, the ordinary electric furnace consists of a box-like arrangement of limestone in which a cavity is cut, the electric current being led into the latter by means of two hard carbon electrodes situated one on either side. On the formation of an arc between the terminals of the electrodes the temperature obtained is usually between 6,000 and 7,000 degrees Fahrenheit, at which heat oxides of even the most refractory metals are immediately fused. Aluminum is thus produced from its oxide very economically, as well as carbide of lime or calcium carbide from which acetylene gas is made.

Various attempts have been made to apply the electric furnace to the smelting of iron ore on a large scale, with questionable success. One type of electric furnace designed for this purpose consists of a large tank filled with alkaline water, in which crucibles with perforated bottoms containing the ore to be treated are suspended. An electrical conductor is connected with the solution below the crucibles, at one side of the tank, while movable metal electrodes come in contact with the ore in the crucibles. In this type of furnace the circuit is completed when the surface of the alkaline solution is raised through the medium of a plunger, and comes in contact with the crucibles. The resistance of the solution in this case is supposed to develop the requisite amount of heat to smelt the ore.

Whether an electric smelter such as the above, or any other form for that matter, can be successfully used in a commercial way to smelt large quantities of ores remains to be seen, but so far the electric smelter has not superseded the old-time furnace. The electric arc is, however, unquestionably finding a sphere of usefulness in the heating of metals for forging. This method would seem to be applicable not only to blacksmith work but to carriage factories, boiler shops—in short in all places where iron forging is a part of the work. Of the various types of electric forges now on the market what is known as the liquid forge is probably the most striking, as its operation appears to be based on a principle directly contrary to the law of nature, in that a piece of metal becomes red hot while immersed in water. The forge itself consists of a tank provided with a metal lining to which the positive wire of a dynamo is attached. The negative conductor is soldered to a pair of tongs with insulated handles with which the piece of metal to be heated is handled. The principle on which the operation of this forge is based is both simple and ingenious. The electric current in passing from one terminal to the other decomposes the water, and a film of hydrogen is formed around the negative wire and the piece of metal to be heated. Hydrogen being a bad conductor of electricity creates a resistance to the passage of the current and causes the energy of the current to be transformed into heat, which immediately raises the temperature of the bar to be heated. A forge of this description was on exhibition at the Chicago World's Fair and created considerable comment. The advantages claimed for the electric forge, and which would seem to be well founded, are economy of space, saving of fuel, time and labor, as well as cleanliness.

* * *

The American Street Railway Association Convention. The Seventeenth Annual Convention of the American Street Railway Association, the proceedings of which will be found elsewhere in this issue, was probably the most successful yet enjoyed by this body. The papers read during the four days of the meeting were comparatively few in number, but the lack of quantity was more than made up for in quality. The attendance was everything that could be desired, there being over 260 delegates present, representing 161 street railway companies, over 130 non-members and almost 200 ladies. The headquarters of the Association was the Hotel Brunswick, but the exercises took place in the Mechanics' Building. Probably one of the most interesting papers read was that entitled "Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use," by Mr. Richard McCulloch, which may be found in full on another page. The writer did not attempt to prove that either the single or the double truck car is the better type. He merely discussed the subject with a view to bringing out the strong and weak points of each type in such a way that the results might be applied to special or local conditions. In the discussion which followed, the general opinion seemed to be in favor of the double-truck car. The other papers read attracted considerable attention, especially that entitled "Cost of Electric Power for Street Railways at Switchboard, both Steam and Water," by Mr. R. W. Conant.

The social features of the Convention were most agreeable, there being a number of pleasant trolley rides to neighboring points of interest, a clambake, a drive in the park, and a shopping trip for the ladies.

The return of the Street Railway Association to

the place of its birth after seventeen years of wandering should long be remembered by all those who were fortunate enough to be present.

* * *

Untimely Death of Dr. John Hopkinson.

In our issue of August 31 we referred in a short paragraph to an announcement of the sudden death of Dr. John Hopkinson, the celebrated English electrical engineer, and that of his son and two daughters while ascending the Dent de Veisivi in Switzerland. This rumor, for it was scarcely more than such at the time, has, we regret, since been confirmed. The untimely death of such a capable electrical engineer and physicist will be deeply deplored by the electrical fraternity on both sides of the Atlantic.

Dr. Hopkinson was born in Manchester, Eng., in 1849. After studying at various schools he entered Cambridge University and while there took the degree of D. Sc. at the London University. He was at one time in the early part of his career assistant to Sir William Siemens, and was connected with some of the first electric traction experiments in Great Britain. The electrical equipment of the celebrated City & South London Railway was designed by him and carried out under his supervision. He was twice elected President of the London Institution of Electrical Engineers and was closely associated with numerous other engineering societies. He was a member of the Council of the British Association and was a fellow of the Royal Society.

Dr. Hopkinson was a frequent contributor to the proceedings of various engineering societies, his best known papers probably being those which relate to magnetism and to the theory of dynamos, although his contributions treating of the electrostatic capacity of bodies are of importance. Dr. Hopkinson possessed the two qualities rarely met with among engineers, namely, a high degree of theoretical knowledge and wonderful practical ability. He introduced many improvements in light-house machinery and brought out what is known as the group flashing apparatus. In short, there is scarcely a branch of electrical engineering which does not bear the mark of his high professional ability by some more or less important improvement. In the death of Dr. John Hopkinson the electrical profession has unquestionably lost one of its most brilliant and hardest workers, which cannot be too deeply deplored.

* * *

Electrical Apparatus of the New Experimental Tank in Washington.

While the small tank which is now being constructed at Washington Navy Yard for testing the speed of miniature war vessels is an experiment in every sense of the word in this country, it is not so on the other side of the Atlantic, where they have been in use, notably in England, since 1872. However, there is probably no tank of this nature in existence at the present time abroad so complete in every detail as will be the one now in course of construction at Washington. The many and persistent efforts of Chief Constructor Hichborn, of the Navy, for the introduction of this facility for changing the rate of speed of proposed vessels from an unknown quantity to an assured certainty, were not productive of effect until Congress two years ago made an appropriation of $105,000 to be devoted to this purpose. The tank it is now confidently expected will be completed by October 1. The purpose to be gained is that all uncertainty in the speed of proposed vessels for the Navy which at present cannot be demonstrated until the trial trip is made, and after an expenditure of several millions of dollars and years of time, can be determined by means of models which it is proposed to test under conditions similar to what the vessels they represent would have to undergo. Thus when the desired speed is not attained the model can be altered so as to meet the requirements, or if this does not prove satisfactory, the model itself may be cast aside and new plans designed.

The building to be devoted to this purpose has been erected in the Navy Yard at Washington, along the east river front. Its dimensions are 500 feet long by 50 feet wide, and has two small extensions at either end. The interior construction shows a basin of concrete 370 feet long by 43 feet wide, with a depth of 14 feet in the center. In one of the extensions will be the heating, ventilating and filtering apparatus, and in the other the necessary electrical equipment. The electrical installation will supply the necessary power for driving the model-towing carriage. The speed will vary from the slowest up to an actual speed of not less than 2,000 feet per minute. The approximate weight of this towing carriage is 45,000 pounds, and it is designed to be driven by four electric motors arranged in pairs. These motors will be wound so as to have a maximum potential of 250 volts, and at the voltage named all four motors acting through suitable gearing will develop the necessary power for attaining the highest rate of speed, i. e., 2,000 feet per minute. The armatures will have a speed of about 800 revolutions per minute, and will be fully capable of carrying the required load for five minutes or even longer if necessary. The controlling gear will be located on the towing carriage. This controlling gear will be so apportioned that not less than 45 different speeds will be available as follows: From 0 to 600 feet per minute, so arranged as to include 24 speeds, increasing by increments of 25 feet; from 600 to 1,300 feet per minute to include 14 increments at a distance of 50 feet apart; from 1,300 to 2,000 feet to include 7 increments of 100 feet distance.

The field of each motor is provided with a rheostat and a Weston ammeter. A voltmeter is connected with the armature circuit of each motor, and again there is one on the main circuit.

The towing carriage will be braked by electricity, the braking arrangement being able to bring the carriage to rest from a speed of 1,000 feet per minute, and that in a distance not exceeding 100 yards. The generator will be of the multipolar direct-connected type. That this tank will prove of great value cannot be doubted, and many times its cost will unquestionably be saved to the Government by a judicious use of the electric towing carriage.

Under the Searchlight.

Notes and Comments on Various Topics.

THE General Electric Company had an "exhibit" at the Boston Street Railway Convention in the form of a globe 24 feet in diameter representing a mapped figure of the world. At night small glow lamps indicated spots on this globe which extensive advertising had enabled the company to reach with its goods, and we are told that the demonstrator pointed with special pride to an isolated kraal in South Africa where there was some of the G. E. apparatus in operation. If any shareholder of the company happened to see this hollow monstrosity, he must have thought: "Well, that is a big thing—on the surface—but there's nothing in it,—and in this respect it fitly represents the company, which has just cut off 40 per cent. of its capital stock, and has paid no dividends for five years. What does it profit if we gain the whole world and lose 40 per cent. of what it cost us to get it?"

* * *

THE engineer in charge of a large electric plant in New Orleans is an exceedingly intelligent young man and usually takes delight in exhibiting the machinery to visitors. He had an experience the other day, however, that greatly cooled his ardor in that direction, as we learn from the *Times-Democrat*. A couple of ladies from abroad had dropped in to see the apparatus, and, as usual, the engineer acted as cicerone. Among other things of interest in the place is a huge belt passing some eight feet above the floor, which generates so much of what is called "static electricity" that the effect on one who stands beneath is literally hair-raising. This is a favorite experiment about the dynamo room and the surprise of strangers always raises a good-natured laugh. With the fact in mind, the young engineer requested one of the ladies to step to a spot which he indicated under the swiftly-moving belt. She innocently did so, but at the next instant clapped both hands to her forehead and uttered a loud shriek. The luxurious curls that had adorned her brow had disappeared in space, and, as a matter of fact, were adhering tightly to the surface of the belt and making exactly 120 revolutions a minute. "Really I—I had no idea—that is, I—" stammered the horrified electrician. "You are a brute, sir!" interrupted the lady, "a low brute," and since then experiments in static phenomena have been discontinued at the establishment.

* * *

P. A. B. WIDENER, one of the incorporators of the American Indies Company, says: "We are authorized by our charter to undertake nearly anything down there. We have with us the wide-awake men in Cuba and Porto Rico, who know the soil and what is in it, and we are going into anything that will make money. It may be steamships, it may be oil, it may be gas, it may be sugar, it may be iron, it may be trolley lines and telephones. We will tell the public further when we are ready. We are going to put up all the money ourselves at present; later we will probably have something to offer the public."

* * *

CONSUL GENERAL DU BOIS reports to the State Department from St. Gall, Switzerland, that on January 1, 1898, 204 lines of electric street railways, with a mileage of 2,250.4 kilometers, were in operation in Europe. The rolling stock consisted of 4,514 motor cars. Germany has 65, France 44, Austria-Hungary 13, Great Britain 24, Switzerland 23 and Italy 11 electric street railways. The system most in use is the overhead trolley, which is operated by 172 lines, while 8 lines have adopted the underground trolley, 8 lines the third-rail system, 13 lines storage or accumulator cars, and 3 lines have a mixed system of overhead trolley and accumulators at certain points of their lines.

* * *

IT is a curious instance of our natural conservatism, says *Lightning*, London, that though science has long solved the problem of artificial cold, no one dreams of cooling his house in summer except by opening the windows, or at most by the use of a ventilating fan. Artificial heat, of course, has been sanctioned by long usage, though the means generally adopted are almost as extravagant as it would be to cool a room with flasks of liquid air. Except for the expense, this would be a pleasant way of relieving the heat and closeness at a public dinner. A few of Professor Dewar's flasks placed at intervals on the tables would make effective table ornaments, would cool the room and renew the atmosphere. Moreover, if liquid oxygen were to take the place of liquid air, who knows what exhilarating effect it might have on the oratory, which is often in need of some such stimulant, while should a guest chance to upset one of the flasks, the excitement might rise to fever pitch.

Annual Meeting of the Street Railway Association of New York.

At Manhattan Beach Hotel on Tuesday, the 13th inst., the members of the above Association met to hold their Sixteenth Annual Convention. The day was pleasant and the delegates, "swept by ocean breezes," felt all the exhilarating influences of the locality and were in a most happy mood. The attendance was quite large, which would seem to assure a full and interesting discussion of the papers to be read, but owing to our forms being put to press we are obliged to defer an account of the proceedings until our next issue. The Convention will continue for two days, the annual banquet being held last night.

AMERICAN STREET RAILWAY ASSOCIATION.

A Great Gathering of Representative Men at the Boston Convention.

WELCOMED BY THE MAYOR AND CORDIALLY RECEIVED BY THE PEOPLE.

Full Report of the Proceedings—Official List of Delegates in Attendance.

The Seventeenth Annual Meeting of the American Street Railway Association was held from the 6th to the 9th inst. at the Massachusetts Charitable Mechanic's Association Hall, Boston. On opening the Convention on the 6th, President Albion E. Lang, of Toledo, O., called the members to order at 11 o'clock A.M., and introduced Mayor Quincy, who delivered an address in which he said:

Mr. President and Gentlemen of the American Street Railway Association: It gives me a great deal of pleasure to welcome you to the city, and to express the hope that the deliberations of this large meeting of the American Street Railway Association may be both pleasant and profitable. The size of this gathering, the wide extent of the representation in this Convention, the financial magnitude of the interests involved, afford a striking illustration of the rapid development which is taking place in the electric transportation interests of the United States. They have to-day won a position as one of the greatest—as one of the most important interests of the country.

I think the economic and social results which are to follow from the development of the electrical street railway are only second in importance to those which have followed from the development of the steam railroad. I think the street railway has progressed far enough in its evolution—although it has by no means filled its full field in this country, or reached the limit of its usefulness—it has progressed far enough to enable us to see that it is an important agency in the promotion of civilization.

Electric railways tend to bind together the various cities and the various towns and the various communities into which mankind is divided into a great unit of communities, all of which understand each other better through the cheap facilities for moving about which have been brought to the world by this comparatively new agency of electricity. And so I am very glad to welcome this Convention to-day as representing a new and potent force which has come into the world by the advancement of mankind.

I am confident that this Street Railway Convention, the largest and most important, I believe, which has been held up to the present time, with its mechanical and electrical exhibits, and with the important matters which are to come before it for consideration, will accomplish something for the still farther progress of this great interest and this great industry. The people of Boston are always glad to welcome these national conventions. Boston has a great electric street railway system. Not only has she one of the very greatest, and I believe one of the very best, street railroad transportation systems to be found anywhere in the world, but we have in the suburbs of Boston, in that chain of cities and towns which encircle Boston proper, which constitute Greater Boston, embracing as it does a million people or more within its limits, we have in these outlying cities, and towns as well, highly developed systems of suburban and of interurban street railway transportation. I am sure, therefore, that this Association could not have selected a better center in which to hold its gathering this year, in which to take account of the progress that has been made in electric street railway work during the last year, and in looking forward to the progress that is still to be made, than in this city of Boston. I can only wish that your visit may be pleasant as well as profitable, and will say in conclusion that if there is anything which the city of Boston, as a corporation, or the citizens of Boston individually, can do to make your stay here a pleasant one, I am sure that it will be very cheerfully done. (Applause.)

President Lang—Mr. Mayor, I am sure that I express the sentiments of this organization when I say that we are glad to be with you. On behalf of the members of this Association I tender to you our thanks for the very cordial welcome you have extended to us and for the interesting remarks you have made.

On motion of Mr. McCormack of Brooklyn, a rising vote of thanks was given the Mayor for his kind address of welcome to the Association.

President Lang—The next order of business will be the calling of the roll. I will say that the Executive Committee have decided to make a departure in the method of calling the roll—we will consider the roll called by accepting the registration at the door as the evidence of the companies represented and the gentlemen who represent them. In that way we will facilitate our business. The next order of business is the reading of the minutes of the last meeting, and unless objection is made the minutes will stand approved as printed. We will now give an opportunity to companies represented that are not members of the Association to acquire membership.

The following companies then joined the Association: Elmira & Horseheads Railroad Company, Elmira, N. Y.; Portchester Traction Company, Portchester, N. Y.; Portland & Yarmouth Electric Railway Company, Portland, Me.; Portsmouth Street Railway Company, Portsmouth, Va.

Mr. Kerper (Dayton)—Mr. President, I desire to offer the following resolutions:

Whereas, The Executive Committee of this Association, at its meeting held in Boston, January 25 and 26, 1898, owing to its inability to secure a proper hall for the annual meeting of the Association at any other time, issued its call for the meeting of the Association to be held in Boston, September 6–9, 1898:

Resolved, That the action of said Executive Committee be and the same is hereby approved, ratified and confirmed, and this meeting is hereby declared to be the regular annual meeting of the Association for the year 1898;

Resolved, That all of the business of the Association be proceeded with at this meeting in accordance with the by-laws of the Association applicable to regular meetings called and held within dates provided by paragraph 7 of said by-laws.

The resolutions were seconded by Mr. Hamilton of Chicago and unanimously adopted.

The next order of business was the address of the President, which is here given in full:

PRESIDENT LANG'S ADDRESS.

The American Street-Railway Association—Gentlemen: We are to-day, for the seventeenth consecutive year, assembled in furtherance of the objects of our Association, under conditions most favorable to a pleasant and profitable meeting; for we are in the house of our father, the city of our birth.

As the presiding officer of the Association, and in the name of the street railway men of Boston, I bid you a hearty, sincere and joyous welcome.

Amid the circumstances of this meeting, our thoughts naturally turn to the time, the persons and the conditions existing when the Association was formed. Some then present are with us to-day, and whether residents of Boston or not, certainly experience a pardonable pride in the growth and achievements of the Association as shown by its published proceedings and emphasized by the large number in attendance.

Of the Boston people who were present at the outset, Calvin A. Richards, president of the Metropolitan Railroad Company, now a part of the Boston Elevated system, was a conspicuous and active member. In 1884 he was elected president of the Association, and those who knew him best feel a deep grief that death has robbed us of a member whose welcome, if present, would know no bounds.

As I trace the history of the Association from its inception, I am convinced that its founders, in the words of Emerson, "builded better than they knew," for is it not remarkable that they should have chosen a name and set forth in our constitution the objects of the Association so wisely and well that no material change has been required to adapt them to present conditions, which are so radically different from those then prevailing?

The constitution then as now says: "The object of this Association shall be the acquisition of experimental, statistical and scientific knowledge relating to the construction, equipment and operation of street railways," etc.

The need for experimental knowledge in connection with a mule goes without saying, and statistical and scientific knowledge with reference to harness, cars or strap-rails sounds very ancient as compared with engines, boilers, generators, girder rails, vestibuled cars, lightning arresters, ohms, volts, watts, amperes, etc., the familiar subjects of to-day. I do not mean, however, to belittle the value of the investigation, discussion and association of the earlier days, because there are too many veterans present (and I might myself be called one) who can testify to the great benefit derived therefrom. It does seem, however, that the necessity for holding meetings in different cities was greater formerly than now, for in order to know very much about what others had done or were doing we had to go to them, whereas now we can see almost everything in connection with our business in the room below, except the mercurial portion known as the State Legislature, common council, tax gatherer and ubiquitous damage lawyer, so-called.

That this is a fair inference is also shown by the records, for the second meeting was held in Chicago, which then as now claimed to be the metropolis of the West, but disputed by St. Louis. While it was doubtless an enjoyable meeting, Chicago was apparently too much of a shock to the nervous systems of our Eastern members, so it was determined to return East the following year and New York was selected. Of course, New York never fails to interest, but there is one obstacle always difficult to overcome in meetings at that point, which is that one cannot remain long enough to see it all. What the delegates failed to find there, however, they looked for the year following at St. Louis, and it proved so good that they naturally looked for more nearby, hence next sought out Cincinnati. Cincinnati, as was expected, proved to be ideal, but the East offered so many attractions in the contest for location that Philadelphia captured the Convention following.

Dignified and made bold by the Philadelphia meeting the cry became, "On to Washington." The pleasure and profit of that meeting cannot be doubted, but the West was evidently becoming jealous, and to secure another meeting played its trump card and Minneapolis won out. It goes without saying that this meeting was profitable to the Association as well as to the good people of Minneapolis. Electricity as a motive power was at that time so far advanced that all knew it was bound to come. Its discussion consumed nearly all the time of the meeting, and we left the Minneapolis people more strongly impressed than ever before that they had made no mistake in adopting electricity as a motive power and that they wanted still more of it.

In journeying to Buffalo the following year the Association was well repaid, for much progress along electrical lines was found, and it undoubtedly stimulated the movement further in this direction, hence a dash was made for Pittsburg the following year. No one will ever forget that great concern, the Westinghouse Electric & Manufacturing Company, which was then and is still so energetic and progressive in the electrical field, and which proved to be such an interesting feature of the meeting.

In going to Cleveland for our next meeting we did wisely, for we there found roads and power houses further advanced towards the goal of perfection than could perhaps at that time have been found at any other place in the country. At the Milwaukee meeting the year following we were met with the most extensive display of electrical apparatus witnessed up to that time, presided over by scores of ever-watchful, energetic and intelligent supplymen, and our meeting proved to be unusually profitable. By this time we were all so firmly established on the electrical foundation that to see an elec-

trical road or inspect electrical appliances was no novelty, but, still searching for greater things, we turned towards Atlanta. We not only found a great exposition of the products of the country here assembled, but very much in the electrical line to interest us. The cordiality of our reception by the people was a crowning feature of this meeting.

In turning our steps toward Montreal, a year later, we endeavored to give of the good things we had seen and experienced at former meetings, and to acquire further knowledge from our Canadian brothers. It was the first attempt at holding a meeting beyond our borders, and for various reasons was slimly attended; still it was not void of profit, for it revitalized the Association to such an extent that the meeting at St. Louis the following year was unusually interesting and valuable. Having had a foretaste of the place, we, of course, were eager to return, and our reception by the people could not have been more cordial. It was left for Niagara Falls, however, to overshadow what up to that time had been considered great, and to reveal to us the vast in electrical units and in nature. We also found the manufacturers and supplymen present in abundance, and our meeting there was voted a success in every particular.

I have thus briefly recounted our movements and spoken of the motives which it has seemed from the best information at hand prompted the Association in selecting its places of meeting, and the value of such selections and other reasons why the Association has grown to its present proportions and standing. Its growth and experiences, like all such organizations, have not been without some severe trials, but unlike the prodigal son, we have wasted none of our substance in riotous living, but have improved at each successive step, and now reach home—not only the birth-place of the Association, but the home of the electrical industries in a larger sense perhaps than any other locality in the world. The people of Boston not only furnished money with a lavish hand to carry forward the work of developing the subtle power now so useful to us and all mankind, but also much of the brains and energy needed to make its use practical. Of this fact, one circumstance will bear witness, and it is that Mr. C. A. Coffin, a Boston man, is still retained at the head of the largest electrical manufacturing corporation in the United States if not in the world.

Having laid in this city the foundation of the splendid structure we have since reared, it is very proper that we should return and dwell therein for a few days. Everything gives promise of this being the largest meeting in our existence. If we do not make it one of the most valuable, the fault will be with ourselves. Let us hope to leave such an impression that the Boston people will say—"It was good to have them with us."

In the growth and development of our Association and the business we represent, let us not forget the priceless and unrivaled assistance rendered by the technical press. Without a spokesman, a guardian ever-faithful to our interests as they have been, our progress would have been slower and our pathway exceeding rough. All honor to those devoted publishers and editors!

Nor must we for a moment forget (if we could) the indefatigable supplyman, for he is the noblest Roman of them all. It is his courage, foresight and energy in taking up the new and useful article, and pressing it upon our attention, that helps to effect economies. We may sometimes be prematurely persuaded, but that is not the fault of the supplyman; it is simply one of the arts of his trade necessary for us to learn. But, seriously, without them the meetings of our Association would be materially weakened and lose much of their interest and value. Let us then not fail to give them and their exhibits all the attention and examination time will permit.

The Executive Committee has prepared a very excellent list of papers to be read, and I trust that all will join in giving them generous discussion. Some of the writers of the papers have told me that they expected more benefit would be derived by members from discussion than from the paper itself. This should be inducement enough to keep all in constant attendance. Bear in mind that in so doing we are also promoting the best interests of the Association, as well as honoring the writers of the papers, which is their due and our duty. While on this subject let me here call attention to the necessity of having at our meetings papers which will interest all the members—not only the mechanical and electrical engineers, but the general managers and even presidents of companies. We need all these officials with us at every Convention, hence we must provide something of interest to them.

Each and every member must be made to feel that he has been benefited by attending our Conventions, and likewise the company represented, or our Association will cease growing. As a result of our deliberations, economies should follow without injury to the public service, all of which will tend toward a further realization of the objects of our Association, which are "the establishment and maintenance of a spirit of fraternity among the members" and in the largest degree "the encouragement of cordial and friendly relations between the roads and the public."

Under the head of general business as provided in our by-laws, or at some other appropriate time, a sort of experience meeting or informal discussion of all subjects relating to our business should take place, where each member shall feel free to ask any question that occurs to him upon which he desires information, and some one stand ready to answer.

I venture to suggest a few subjects arising almost daily where in this way very helpful information could be obtained, viz.:

1. The suburban railroads—on what terms and conditions should they enter over our tracks, and how can their building be encouraged.
2. The issuing of transfer checks or tickets, and how abuses connected therewith can be limited.
3. The equipping of buildings with automatic sprinklers and the economies resulting therefrom.
4. The cost of electric welding of rail joints and the saving effected in current and cars.
5. The discussion or agitation of municipal ownership of franchises and the most intelligent way to treat the subject.
6. To what extent companies should engage in the amusement business and the best methods of conducting the same.
7. A comparison of the cost of materials and supplies and expenses of operation.
8. How best to promote the interests of employes, and in return secure from them the highest degree of service and loyalty.

These and many other subjects of kindred nature considered in this manner would awaken great interest.

I desire to call attention to our fellow-workers and associates, the Accountants' Association, which hold their meetings simultaneously with ours each year, and are even now in session in another part of the building. The whole business of the street railway revolves around the accountant's office, and many of us can attest the value of having efficient persons in charge thereof. It is with the hope of enabling them to make their services more valuable to their respective companies that the Association was formed, hence they should receive every assistance it is possible for us to render. I bespeak for them your cordial co-operation.

In closing I wish to thank our efficient Secretary and the Executive Committee for their cordial aid and support during the year, and to assure the members of the Association of my great appreciation of the honor of being called a year ago to the office of President.

The President—The next business in order will be the report of the Executive Committee, which will be read by the Secretary.

The minutes of the meetings of the Executive Committee held at Boston January 25 and 26 and September 5 and 6, 1898, were then read. These minutes contained an account of the routine business of the committee, among other things fixing the date of the Convention, arranging for the exhibits, assigning the topics for papers, regulating the issuance of banquet tickets, etc.

The committee also recommended the adoption of the following rules for the Convention:

1. No member will be recognized by the President unless he shall announce distinctly his name and address.

2. Speeches will be limited to ten minutes unless the time shall be extended by the Convention.

3. Members who desire to offer resolutions or other matters to be considered by the Convention are requested to submit them in writing over their signatures to the Secretary.

Mr. Hamilton (Chicago)—I move that the report of the Executive Committee be received and approved, and the recommendations presented be concurred in, and that the thanks of the Association be extended to the officers and Executive Committee for the very able manner in which they have conducted the business of the Association for the past year.

The President—We will now listen to the report of the Secretary and Treasurer.

The report of the Treasurer was presented, showing the financial condition of the Association to be as follows:

Balance, October 18, 1897	$2,931.48
Receipts	6,376.65
	$9,307.65
Expenses	5.651.37
Balance, September 5, 1898	$3,656.28

The Association has a membership of 161 companies.

On motion of Mr. Radel of New Brunswick, N. J., the report of the Secretary and Treasurer was received and adopted.

The President—We will now take up the committee reports. The first paper is on "Comparative Earnings and Economy of Operation between Single and Double Truck Cars for City Use," by Richard McCulloch, Electrical Engineer Cass Avenue and Citizens' Street Railway Companies, St. Louis, Mo.

Mr. McCulloch read the paper, after which the President remarked that the paper was a very interesting and able one, dealing with a subject in which all were interested, and invited a discussion of it.

[The paper will be found elsewhere in this issue.]

The Secretary read a letter from Mr. Henry M. Watson, president of the Buffalo Railway Company, regretting his inability to be present at the meeting on account of sickness.

Mr. Kelly (Columbus)—It has been suggested that all the members of the Association who were present at the organization of the Association in Boston in 1882 will rise.

Messrs. W. Worth Bean, St. Joseph, Mich.; George B. Kerper, Dayton, O., and Julius E. Rugg, Boston, were the only members present who had attended the organization meeting.

After the Secretary announced that the special train for Lexington and Concord would leave at 2:30 P.M., and that at 8 o'clock there would be a reception in the Convention Hall, a motion for adjournment until 9:30 Wednesday morning was carried.

WEDNESDAY'S SESSION.

President Lang called the meeting to order at 10:30 A.M. and announced that the first paper of the session would be that on "Carrying of United States Mail Matter on Street Railways," by Mr. W. S. Dimmock, General Superintendent Omaha & Council Bluffs Railway & Bridge Company, Council Bluffs, Iowa.

Mr. Dimmock read the paper and a discussion on it followed in which Mr. Sargeant of Boston, Messrs. Beggs and Payne of Milwaukee, Mr. Farson of Chicago, Mr. Robert McCulloch of St. Louis, and Mr. Dimmock took part.

In his remarks Mr. Farson suggested that a committee be appointed, to act under the direction of the Executive Committee, for the purpose of obtaining from the different members such facts relative to street railway mail service as would enable the committee to present the matter in proper form to be brought before the postal authorities. A motion to this effect was put to vote and carried and the President announced that he would appoint the committee.

The President—We will now take up the next paper, "Maintenance and Equipment of Electric Cars for Street Railways," by Mr. M. S. Hopkins, Electrician Columbus Street Railway Company, Columbus, Ohio.

The Secretary read the paper, which was discussed by Mr. Sloan of Chicago, Mr. Hawken of Camden, Me., and Mr. McCormack of Brooklyn.

The President—Gentlemen, Mr. Caryl Ely, the First Vice-President of the Street Railway Association of the State of New York, has an invitation to extend to this Association, and he will now be given an opportunity of presenting it.

Mr. Ely—Mr. President and Gentlemen of the Association: The Annual Convention of the New York State Street Railway Association will be held at the Manhattan Beach Hotel next Tuesday and

Wednesday, and in behalf of that Association, and upon the suggestion of Mr. G. Tracy Rogers, its President, I take pleasure in presenting to you the invitation of that Association to such of you as may be able to do so to meet with that Association next week; and in that cool place, amid the singing of the murmuring waves, we may be able to get cooled off after the fatigues of this occasion.

Mr. Goff, Fall River—I move, Mr. President, that the thanks of the Association be extended to the New York Association, through Mr. Ely, for their very kind invitation to meet with them next week.

Carried.

The President—The Secretary has some communications in regard to the place for holding the next Convention.

The Secretary read letters from the Detroit Citizens' Street Railway Company, the Detroit Electric Railway Company and the Fort Wayne & Belle Isle Railway Company, Detroit, inviting the Association to meet in Detroit next year.

Mr. Holmes, Kansas City—I would like to introduce Col. Morse, who will extend an invitation to this Convention to hold its next meeting in Kansas City.

Col. Morse, of Kansas City, spoke of the advantage of that city as a place for holding the next Convention, and extended a most hearty invitation to the Association to meet there in 1899.

The President—These invitations will be received and referred to the Committee on Nominations for consideration. I will now name that committee: Mr. W. Worth Bean of Michigan, chairman; Mr. H. G. Hamilton of Missouri, Mr. E. C. Foster of Massachusetts, Mr. W. F. Kelly of Ohio, Mr. J. R. Chapman of Illinois, Mr. Henry C. Payne of Wisconsin, and Mr. E. H. Davis of Pennsylvania.

The Secretary announced that special cars would be in front of the Hotel Brunswick at 2 o'clock to take the delegates to the wharf to board the steamer at 2:30 P. M. for Nantasket Beach.

On motion of Mr. Kelly the Convention adjourned until 9:30 o'clock Thursday morning.

THURSDAY'S SESSION.

President Lang called the meeting to order at 10:30 A. M.

The President—The International Association of Factory Inspectors are now in session at the House of Representatives. It has been suggested that we send them an invitation to attend our sessions and to inspect the exhibits.

Mr. Robert McCulloch moved that such an invitation be sent and the motion was carried.

The President—We will now take up the first paper on this morning's programme, "To What Extent Should Street Railway Companies Engage in the Amusement Business," by Walton H. Holmes, general manager Metropolitan Street Railway Company, Kansas City, Mo.

Mr. Holmes read the paper. An interesting discussion followed, the speakers being Mr. Wyman of New Orleans, Mr. Davis of Williamsport, Mr. Holmes of Kansas City, Mr. John I. Beggs, Mr. Harrington of Camden, Mr. Farson, Mr. Claflin of Boston, Mr. Lang of Toledo, Mr. Chapman of Chicago, Mr. Thompson of Muskegon, Mr. Cahoon of Elmira, N. Y., Mr. Jones of Memphis and Mr. Heft of Meriden, Conn.

The President—We will now take up the report of the Nominating Committee.

Mr. W. Worth Bean, chairman, presented this report, as follows:

For President—Chas. S. Sergeant, 2d vice-president Boston Elevated Railway Co., Boston.

First Vice-President—Henry C. Moore, president Trenton Street Railway Co., Trenton, N. J.

Second Vice-President—Ernest Woodruff, president Atlanta Consolidated Street Railway Co., Atlanta, Ga.

Third Vice-President—Walton N. Holmes, general manager Kansas City Railway Co., Kansas City, Mo.

Secretary and Treasurer—Thomas C. Penington, treasurer Chicago City Railway Co., Chicago, Ill.

Executive Committee—Albion E. Lang, president Toledo Traction Co.; George E. Yuille, second vice-president West Chicago Street Railroad Co.; Frank Jones, president Memphis Street Railway Co.; John I. Beggs, general manager Milwaukee Railway and Light Co.; Ira McCormack, general superintendent Brooklyn Heights Railway Co.

Next place of meeting—Chicago, provided that facilities satisfactory to the Executive Committee as regards proper hall for Convention and exhibition purposes be furnished without expense to the Association.

On motion of Mr. Shaw of Boston the report of the committee was accepted, and the Secretary was authorized to cast the ballot of the Association for the gentlemen nominated as above, and they were officially declared the officers of the Association for the ensuing year.

Mr. Farson (Chicago)—May I not compliment the committee on this admirable report and the splendid selection of officers, and also upon their selection of Chicago for the next place of meeting. I may say on behalf of the street railway people of Chicago that we will do everything in our power to make the Convention interesting, profitable and instructive. We will welcome you, gentlemen, with open arms. (Applause.)

The President—I will appoint as the committee provided for in the motion regarding the carrying of United States mail matter on street railways the following gentlemen: John T. Burnett, Boston; Henry C. Payne, Milwaukee; Ira A. McCormack, New York; D. G. Hamilton, Chicago; W. S. Dimmock, Council Bluffs.

A letter from the Boston Elevated Railway Company, inviting the delegates to visit any or all of the various power plants, shops, car houses, etc., of the company, was read by the President. Other invitations were also presented, and letters of regret at inability to attend from Past President C. B. Holmes and Mr. D. B. Dyer of Augusta, Ga, were read.

The President—I have been informed that Mr. T. Y. Dzushi, Chief of Finance and Manager of Stores of the Imperial Government Railways of Japan, and Mr. K. Sugahara, Chief Engineer of the Kobu and of some street railroads soon to be built in Japan, are in the room, and have been attending this Convention since it opened, and I think that in some way we should express our pleasure in meeting them.

A motion by Mr. Ely that the privileges of the floor be extended to these gentlemen and that they be invited to address the Convention was carried.

Mr. Sugahara—Mr. President and Gentlemen: It is a great privilege and honor to have the pleasure of meeting you on this memorable occasion, and to occupy a seat in this National Convention of Street Railways in this great country. I desire to express my sincere gratitude for your hospitality extended to me as well as to my friend Mr. Dzushi. Japan is achieving a great deal in her material progress and is striving to accomplish in rapid succession what she learns from abroad. Your venerable Commodore Perry opened our gate toward Western civilization some forty-four years ago, and to-day your generous discoveries and inventions lead us hand in hand in the march of material civilization, for which we are greatly indebted to your people and country. I am naturally devoted to the investigation of street railway construction, and you can hardly imagine how interesting and helpful it is to me to be present in this great Convention.

The progress of our street railway system is very slow and it is in a primitive stage as yet. For instance, our street railways altogether are only about 60 miles in length and most of them depend on horse power, except the Kyoto and Nagoyo electric lines. Several electric railways, however, have been projected in different cities and towns throughout the country. We are firm in our belief that in the near future Japan will be found a network of electric street railways. Should I engage in Tokio street railways after returning home, and apply the knowledge I have gained here, I shall be very much indebted to you all and must pay cordial thanks. We have about 40,000 jinrikishas and 90 000 wagons drawn by men as means of transportation in Tokio, which greatly interferes with the progress of street railways. Notwithstanding these difficulties, Tokio horse car railway companies pay on the capital invested 30 per cent. dividends annually, and our steam road 13 per cent. We have no doubt that to build street railways in Tokio is one of the most promising enterprises. It is my great desire that our country shall progress in such a degree that when any of you shall come to Tokio you may go to any place in the city by street cars, not by jinrikisha, and that our country may be seen as one of the industrial countries of the world, and not alone a country of beauty and curiosity. Thanking you again for the kind privilege given us, and hoping you all may enjoy the blessings of health, liberty and prosperity, I beg to conclude my remarks.

The President—Gentlemen, I am sure that I express the feelings of all the members of this Association when I say that it is a great pleasure for us all to meet you. I take pleasure in presenting to you a badge that will admit you to all our sessions and every exhibit in the building, and I believe to every home in the city of Boston. I trust you will carry these with you with our best wishes. I also desire to present you with tickets to the banquet to-night, and we will be glad to have you join us at that time.

Mr. Dzushi—Gentlemen, it affords us great pleasure to meet you here. I desire to express our hearty thanks for your kind invitation.

Mr. Payne (Milwaukee)—I desire on my own behalf, and I have no doubt on behalf of all the members of the Association, to return to the members of the Massachusetts Street Railway Association and to members of the local committees, and all those who have interested themselves in entertaining us in the city, our sincere thanks for the magnificent manner in which they have done their work. I think it is not too much to say that the arrangements for this Convention have not been excelled in any place where we have met, certainly not where I have been in attendance upon the meeting. It is but proper that we should make known our feelings in that regard, and I offer a resolution that the Secretary be instructed to tender to these persons the heartfelt thanks and appreciation of the members of this Association.

Mr. Chapman seconded the motion, which was duly carried.

Mr. Payne (Milwaukee)—One thing more. I do not know whether it is the proper time, but I think the members of the Association will desire to place upon record their appreciation of the manner in which the officers during the last year have performed their duties, and I therefore desire to move that the thanks of the Association be tendered to the retiring President and the other members of the Executive Committee of the Association.

Mr. Payne put the motion, which was unanimously carried.

President Lang—I thank you very much, gentlemen, for this expression. We have only done our duty, and we hope the result of our labors will be beneficial to all who attended our meetings and all who may read the report of this meeting when published.

Mr. Ely (Niagara Falls)—I move that a special vote of thanks be extended to the members of the ladies' reception committee who have been so untiring in their efforts for the entertainment of the visiting ladies, and who have expended so much time and pains in making their stay pleasant here.

Carried.

The Secretary—I will announce the names of some new companies that have joined the Association since the opening of this meeting. They are: Warren, Brookfield & Spencer Street Railway Co., Warren, Mass.; Brockton, Bridgewater & Taunton Street Railway Co., Boston, Mass.; Providence & Taunton Street Railway Co., Taunton, Mass.; Milford, Holliston & Framingham Street Railway Co., Framingham, Mass.; South Chicago City Railway Company, Chicago, Ill.; St. Joseph Railway, Heat, Light & Power Company; Fair Haven & Westville Street Railway Co., New Haven, Conn.

The President—We will now have the paper on "Inspection and Testing of Motors and Car Equipments by Street Railway Companies," by Mr. Frederick D. Perkins, Electrical Engineer Toledo Traction Company, Toledo, Ohio.

Mr. Perkins was present, but owing to his indisposition the paper was read by the Secretary. On account of the lateness of the hour, the paper was on motion filed without discussion.

The President announced the trip to Plymouth in the afternoon, and the annual dinner in the evening, after which the meeting adjourned.

FRIDAY'S SESSION.

The President called the meeting to order at 10:40 A. M., and announced that the first business would be the paper on "Cost of Electric Power for Street Railways at Switchboard, both Steam and Water," by R. W. Conant, Electrical Engineer Boston Elevated Railroad Company, Boston, Mass.

Mr. Conant read the paper and was highly complimented by the President and by several of the delegates for the ability and labor he had expended in its preparation; but it was of such a nature that all thought its discussion at that time would do it an injustice.

The motion of Mr. Sergeant that the thanks of the Association be extended to the writers of all the papers presented at the meeting was then unanimously adopted.

The report of the Committee on Standard Rules for Government of Conductors and Motormen was incomplete, and an extension of time was granted the committee to formulate a set of rules to be submitted to the next Convention. The committee was also granted an allowance of $200 for the printing and mailing of the rules.

The President announced that it was the desire of the Secretary that members of the Association should indicate topics upon which it would be desirable to have papers prepared for the next Convention, and that they should also suggest a person who would prepare the paper.

The President—The only remaining thing for us to do is to install the newly elected officers, and the installation of the officers is usually represented by the installation of the President. I will appoint Mr. Chapman of Chicago and Mr. Davis of Williamsport a committee to escort the newly elected President to the chair.

The Secretary then read the names of all the officers elected.

The President—Gentlemen: It is needless for me to introduce Mr. Sergeant to you, but I desire to say that I appreciate the high honor you conferred upon me a year ago in electing me to this office, and I bespeak for Mr. Sergeant your kind and considerate attention to his communications. If you do as much for him as you have done to make this Boston meeting a success, we will have a splendid meeting at Chicago next year.

President-elect Sergeant—Gentlemen and Members of the American Street Railway Association: I wish to thank you most heartily for my most sudden elevation to office. I feel proud to be permitted to serve you for the coming year. I cannot hope, perhaps, to give as good an administration as my immediate predecessor, Mr. Lang, whose efforts in behalf of the Association I am sure you all appreciate, and the success which has crowned these efforts, and the long line of past Presidents, is one which fills the mind of a new incumbent with some embarrassment, based on the idea that there is a standard which must be upheld. As to this Association, I feel strongly that it has a great work to do, that its meetings are not merely a pleasant vacation, that it is not called together merely for the purpose of reading and discussing the papers, but I believe in the complex relations which are continually coming forward as between the committees and the municipalities and the State governments and street railways, that much is to be gained by concerted action. Certainly in Massachusetts we have benefited very greatly from the fact that our street railways have pulled together for what they knew was right, and they have succeeded after a struggle covering many years in obtaining a settlement which I suppose, looked at from all sides, could be called a fair settlement of the relations of the street railways and the community. I hope that the trial which is being made here of this new plan by which the oppressors of the street railways in a great many communities have been shown by an act of the Legislature how far the street railways are liable to perform work which is not in the line of street railway practice, and by which the street railways themselves are compelled to pay a portion of their receipts for the benefit of the highways—it seems to me that all this work which has been done is instructive and is the beginning of a proper recognition of our industry over the whole country. I assure you, gentlemen, when I first went into the street railway business, particularly in the operating department, I was perfectly appalled; it seemed to me I was in an unlawful business, and everybody was down on the street railway, for it was hampered and troubled by one requirement and exaction after another, and when we made complaints the answer to it all was, "You are in the public streets, you encumber the streets, and you must pay for it." How much better it is to know what we have to pay for, than it is to be put to such payment that may devolve upon us in the judgment of some subordinate road department official in some municipality. I think in such ways as that, and in this matter which was taken up the other day, of the mail service, simply in having our case presented in order to get proper recognition, the Association has a field perhaps greater than any it has yet filled, and I can only say in closing that so far as it lies in my power to further the work of the Association and benefit the interests of street railways, I shall certainly do so. I thank you very much, gentlemen, for the honor.

Ex-President Lang—I now declare the newly elected officers to be duly installed, and take pleasure in handing to the new presiding officer the gavel, with my best wishes. (Applause.)

President Sergeant—I believe that the constitution of our Association provides that the newly elected officers shall enter upon their duties after the annual meeting is adjourned, and as it seems almost as if some duties were about to be forced upon me, I suppose for that reason a motion to adjourn would be in order.

Mr. Goff (Fall River)—I move you, Mr. President, that we now adjourn to meet in Chicago in 1899.

The motion was adopted and the Convention adjourned.

Besides the regular delegates there were present at the Convention as many as 134 non-members, representing the leading street railway and manufacturing interests of the country. The attendance of ladies was unusually large, there being in all about 200, hailing from widely scattered localities such as Buffalo, Chicago, New York, Cleveland, Detroit, Kansas City, Memphis, Philadelphia, and even Liverpool, England.

The exhibits were numerous and were of the usual character. The supplyman was present in greater force than ever before, there being between five and six hundred men present interested in the diffusion of electrical and kindred appliances.

DELEGATES AT THE CONVENTION.

Allentown, Pa.—A. F. Walter, sec. and treas., and Jilson J. Coleman, director, Allentown & Lehigh Valley Traction Co.

Alton, Ill.—J. F. Porter, pres., and H. H. Harrison, elec., Alton Railway & Illuminating Co.

Atlanta, Ga.—E. Woodruff, pres., J. Carroll Payne, vice-pres., Thomas Elliott, chief eng., and N. W. L. Brown, elec., Atlanta Consolidated Street Railway Co.

Baltimore, Md.—P. O. Heilholtz, elec. eng., J. M. Christopher, mast. mech., and D. E. Evans, Baltimore Consolidated Railway Co.

Battle Creek, Mich.—L. N. Downs, pres., E. Hope Norton, vice-pres., Dee Allen, sec., and Fred. I. Griswold, gen. man., Michigan Traction Co.

Bay City, Mich.—W. R. Morrison, asst. gen. man., and R. S. Ashe, supt., Bay Cities Consolidated Street Railway Co.

Binghamton, N. Y.—G. Tracy Rogers, pres., J. P. E. Clark, man., Binghamton Railroad Co.

Boston, Mass.—William A. Bancroft, vice-pres., Charles S. Sergeant, second vice-pres., R. H. Derrah, executive clerk, J. H. Goodspeed, compt., J. E. Rugg, supt. of transportation, John Balch and Chas. H. Bigelow, eng. dept., Boston Elevated Railway Co.

Bridgeport, Conn.—Andrew Radel, pres., and George H. Sanford, counsel, Bridgeport Traction Co.

Brockton, Mass.—Horace B. Rogers, gen. man., and John P. Morse, director, Brockton Street Railway Co.; A. C. Ralph, supt., A. B. Williams and P. W. Sprague, Brockton, Bridgewater & Taunton Street Railway Co.

Brooklyn, N. Y.—Clinton L. Rossiter, pres., Ira A. McCormack, gen. supt., and J. H. Vanderveer, supt. motor dept., Brooklyn Heights Railroad Co.; M. W. Conway, contractor, Brooklyn City & Newtown Railroad Co.; Albert L. Johnson, pres., Wm. F. Ham, sec. and Frank S. Drake, gen. supt., Nassau Railroad Co.

Buffalo, N. Y.—George Chambers, supt., Buffalo Traction Co.; Robert Dunning, mast. mech., and R. E. Danforth, supt., Buffalo Railway Co.

Butte, Mont.—Jesse R. Wharton, Butte Consolidated Railway Co.

Camden, N. J.—George Browning, treas., and Walter E. Harrington, gen. man., Camden & Suburban Railway Co.

Charleston, S. C.—F. D. McEowen, sec. and treas., T. W. Passailaique, gen. supt., and A. S. Boyer, director, Charleston City Railway Co.

Chicago, Ill.—John Farson, pres., and H. M. Sloan, gen. man., Calumet Electric Railway Co.; T. C. Penington, treas., Frank R. Greene, sec., G. W. Knox, elec. eng., C. J. Reilly, chief eng., A. C. Heidelberg, asst. supt., Charles E. Moore, mast. mech., Walter V. Penington, clerk, J. J. O'Keefe and G. O. Nagle, Chicago City Railway Co.; John M. Roach, second vice-pres. and man., James R. Chapman, man. elec. dept., and John Miller, mast. mech., North Chicago Street Railroad Co.; George A. Yuille, asst. gen. man., and W. Frank Carr, engineer, West Chicago Street Railroad Co.

Cincinnati, O.—Bert L. Kilgour, elec., Cincinnati Street Railway Co.

Cleveland, O.—John Ehrhardt, asst. sec., Cleveland City Railway Co.; H. J. Davies, asst. sec. and treas., and W. G. McDole, aud., Cleveland Electric Railway Co.

Colorado Springs, Col.—A. L. Lawton, gen. man., Colorado Springs Rapid Transit Railway Co.

Columbus, O.—W. F. Kelly, gen. supt., and P. V. Burington, aud., Columbus Street Railway Co.

Council Bluffs, Ia.—W. S. Dimock, gen. supt., Omaha and Council Bluffs Railway & Bridge Co.

Dayton, O.—George B. Kerper, gen. man., George B. Kerper, Jr., asst. gen. man., People's Railway Co.

Derby, Conn.—H. Holton Wood, pres., B. W. Porter, gen. man., and W. J. Clark, Derby Street Railway Co.

Detroit, Mich.—T. C. Hutchins, vice-pres., Detroit Citizens' Street Railway Co.

Elmira, N. Y.—J. B. Cahoon, gen. man., Elmira & Horseheads Railway Co.

Findlay, O.—Charles D. Kinney, treas., and Chas. F. Smith, supt., Findlay Street Railway Co.

Fall River, Mass.—Robert H. Goff, pres. and man., H. Read, treas., J. H. Bowker, supt., and G. W. Palmer, Jr., elec. eng., Globe Street Railway Co.

Galveston, Tex.—F. W. Pratt, supt. and eng., Galveston City Railroad Co.

Girardville, Pa.—E. W. Ash, gen. man., and C. A. Bragg, director, Schuylkill Traction Co.

Gloucester, Mass.—W. B. Ferguson, pres., Gloucester Street Railway Co.

Hamilton, Ont.—V. H. Wagoner, elec. and mech. eng., and J. F. Little, Hamilton Street Railway Co.

Harrisburg, Pa.—F. B. Musser, supt., Mason D. Pratt, eng., Harrisburg Traction Co.

Hartford, Conn.—E. S. Goodrich, pres., Elmer M.

White, cashier, Hartford Street Railway Co.

Hazleton, Pa.—A. Markle, gen. man., and G. W. Thompson, supt., Lehigh Traction Co.

Hoboken, N. J.—G. T. Lister, and., and W. S. Hall. supt., North Hudson County Railway Co.

Houston, Tex.—A. H. Parlin, pres., and Newton Jackson, adjuster, Houston Electric Street Ry. Co.

Indianapolis, Ind.—Miller Elliott, supt., Citizens' Street Railroad Co.

Jersey City, N. J.—Charles Y. Flanders and Ralph H. Beach, directors, Consolidated Traction Co.

Johnstown, Pa.—H. C. Evans, director, Johnstown Passenger Railway Co.

Kalamazoo, Mich.—L. N. Downs, pres., Dee Allen, sec., F. N. Rowley, treas., Michigan Traction Co.

Kansas City, Mo.—Charles F. Morse, pres., and W. H. Holmes, vice-pres. and gen. man., Metropolitan Street Railway Co.

Lansing, Mich.—Lawrence Barrett, treas., Lansing City Electric Railway Co.

Lawrence, Mass.—Alfred A. Glazier, vice-pres., N. E. Morton, supt. Lawrence div., and Franklin Woodman, supt. Haverhill div., Lowell, Lawrence & Haverhill Street Railway Co.

London, Ont.—C. E. A. Carr, gen. man., London Street Railway Co.

Long Island City, N. Y.—J. R. Beetem, vice-pres., New York & Queens County Railway Co.

Lowell, Mass.—P. F. Sullivan, man., and Percy Parker, treas., Lowell & Suburban Railway Co.

Lynn, Mass.—C. M. Wicker, pres., North Shore Traction Co.; Amos F. Breed, pres., E. C. Foster, gen. man., H. C. Page, supt. Salem div., William Pestell, elec., and H. E. Farrington, Lynn & Boston Railroad Co.

Manchester, N. H.—E. P. Shaw, Jr., gen. man., and N. H. Walker, supt., Manchester Street Railway Co.

Memphis, Tenn.—F. G. Jones, vice-pres. and gen. man., and C. A. Ruddock, director, Memphis Street Railway Co.

Meriden, Conn.—N. H. Heft, pres., G. Stanley Heft, elec. eng., Charles P. Clark, J. Smith, mast. mech., John E. Vaughan, elec. eng., John Henney, Dr. F. B. Devons and E. C. Boynton, Meriden Electric Railroad Co.

Mexico, City of—Arthur S. Partridge, eng., Compania de Ferrocarriles del Distrito Federal de Mexico.

Milwaukee, Wis.—Henry C. Payne, vice-pres., John I. Beggs, gen. man., T. E. Mitton, gen. supt. railway dept., H. C. Mackay, comp. and aud., and E. W. Olds, supt. rolling stock, Milwaukee Electric Railway & Light Co.

Minneapolis, Minn.—J. F. Calderwood, sec., Twin City Rapid Transit Co.

Mobile, Ala.—J. H. Wilson, pres. and man., Mobile Light & Railroad Co.

Milford, Mass.—W. B. Ferguson, pres., and G. A. Butman, sec. and treas., Milford, Holliston & Framingham Street Railway Co.

Nashville, Tenn.—E. G. Connette, gen. man., and George Swint, gen. supt., Nashville Street Railway Co.

New Bedford, Mass.—E. E. Potter, gen. supt., A. C. Gardiner, treas., and I. W. Phelps, claim agt., Union Street Railway Co.

New Britain, Conn.—Lincoln S. Risley, clerk, Central Railway & Electric Co.

New Brunswick, N. J.—Edward H. Radel, gen. man., and R. L. Rand, supt., Brunswick Traction Co.

Newburyport, Mass.—Charles Odell, pres., and W. P. Clark, director, Newburyport & Amesbury Street Railroad Co.

New Orleans, La.—C. Densmore Wyman, gen. man., New Orleans Traction Co.

New Haven, Conn.—L. Candee, sec. and treas., Fair Haven & Westville Railroad Co.

Newark, N. J.—W. H. Adams, asst. elec. eng., Newark & South Orange Railway Co.

Niagara Falls, N. Y.—C. K. Marshall, supt., Buffalo & Niagara Falls Electric Railway Co.

Norfolk, Va.—R. Lancaster Williams, pres., and D. H. Hegarty, gen. supt., Norfolk St. Railroad Co.

North Tonawanda, N. Y.—W. Caryl Ely, pres., Niagara Falls & Buffalo Electric Railway Co.

Norwalk, Conn.—William P. Acton, gen. man., and A. B. Hill, eng., Norwalk Street Railway Co.

Norwich, Conn.—W. A. Tucker, pres., P. L. Saltonstall and W. L. Adams, Norwich Street Railway Co.

Omaha, Neb.—D. H. Goodrich, sec., Omaha Street Railway Co.

Philadelphia, Pa.—J. C. Lugar, gen. man., W. H. Janney, supt., and John A. Brill, director, Roxborough, Chestnut Hill & Norristown Railway Co.

Pittsburg, Pa.—J. G. Carroll, United Traction Co.

Port Huron, Mich.—William Canahan, pres., and W. L. Jenks, treasurer, City Electric Railway Co.

Portsmouth, Va.—Horace G. Williams, pres., Portsmouth Street Railway Co.

Portland, Me.—William R. Wood, pres., A. Whitney and Charles F. Libbey, directors, and E. W. Newman, gen. man., Portland Railway Co.; W. G. Wheildon, treas., Portland & Yarmouth Electric Railway Co.

Providence, R. I.—A. T. Potter, gen. man., H. V. A. Joslin, sec., A. E. Potter, supt. trans., M. H. Bronsdon, chief eng., W. D. Wright, elec., Union Railroad Co.

Portchester, N. Y.—N. H. Heft, elec. eng., and W. J. Clark, director, Portchester Electric Ry. Co.

Quincy, Ill.—E. K. Stone, Jr., sec., and C. E. Stone, asst. supt., Quincy Horse Railway & Carrying Co.

Quincy, Mass.—John R. Graham, pres., Fred. W. Smith, treas., Benjamin J. Weeks, supt., A. D. Gore, supt. of construction, D. J. McLane, chief elec., Quincy & Boston Street Railway Co.

Reading, Pa.—John A. Rigg, pres., S. P. Light, W. R. McIlvain and R. E. Moore, directors, United Traction Co.

Richmond, Va.—E. Randolph Williams, pres., and P. L. Williams, treas., Richmond Traction Co.

Rochester, N. Y.—J. W. Hicks, supt., Le Grand Brown, chief eng., J. H. Stedmand, man. transfers, Rochester Railway Co.

Rockland, Me.—Thomas Hawken, supt., H. C. Weston, asst. supt., Valentine Chisholm, elec., and F. B. Lee, Rockland, Thomaston & Camden Street Railway Co.

Sioux City, Ia.—Chester P. Wilson, elec. eng., Sioux City Traction Co.

Springfield, Mass.—George W. Cook, cashier, George S Webb, elec., George F. Reed, elec. supt., and F. E. Sarrin, roadmaster, Springfield Street Railway Co.

Springfield, Ohio.—S. L. Nelson, gen. man., L. O Williams, supt., L. F. Purcell, director, Springfield Railway Co.

St. Joseph, Mich.—W. Worth Bean, pres., St. Joseph & Benton Harbor Electric Railway and Light Co.

St. Joseph, Mo.—W. T. Van Brunt., vice-president, and J. H. Van Brunt, supt. of railway, St. Joseph Railway, Light, Heat & Power Co.

St. Louis, Mo.—D. G. Hamilton, pres., Robert McCulloch, gen. man., Richard McCulloch, elec. eng., and Bruce Hamilton and Frank J. Duffy, Citizens' Railway Co., Cass Avenue & Fair Grounds Railway Co. and St. Louis Railroad Co.; F. B. Brownell, receiver, People's Railway Co.; Harry Scullin, vice-pres. and gen. man., and C. H. Pierson, mast. mech., Union Depot Railroad Co.

Syracuse, N. Y.—William H. Tucker, Syracuse Rapid Transit Co.

South Chicago, Ill.—William Walmsley, supt., South Chicago City Railway Co.

Taunton, Mass.—S. M. Thomas, pres., George F. Seibel, supt., Taunton Street Railway Co.

Toledo, O.—Albion E. Lang, pres., E. J. Bechtel, supt. construction, George A. Cooke, asst. supt., and Fred. B. Perkins, elec. eng., Toledo Traction Co.

Topeka, Kan.—Albert M. Patten, supt., Topeka Railway Co.

Trenton, N. J.—Henry C. Moore, pres. and gen. man., P. E. Hurley, supt., R. S. Woodruff, director, and Samuel Moore, Trenton Passenger Railway Co., Consolidated.

Wakefield, Mass.—C. W. Holmes and W. M. Butler, directors, Mystic Valley Street Railway Co.; Joseph F. Shaw, treas., and George A. Butman, director, Wakefield and Stoneham Street Railway Co.

Washington, D. C.—R. W. Palmer, elec., Capital Traction Co.; Theodore J. King, sec., and A. B. Coppes, auditor, Columbia Railway Co.

Waterbury, Conn.—M. E. Stark, supt., Waterbury Traction Co.

Webb City, Mo.—F. H. Fitch., supt., and H. P. Fitch, sec., Southwest Missouri Electric Railway Co.

Wilkes-Barre, Pa.—John Graham, treas. and gen. man., J. C. Meixel, supt., James Fagan, elec. eng., and P. R. Raife, Wilkes-Barre & Wyoming Valley Traction Co.

Williamsport, Pa.—Ernest H. Davis, gen. man., Charles T. Herrick, supt. motive power, James O. Goole, supt. of power, Williamsport Passenger Railway Co.

Worcester, Mass.—Francis H. Dewey, pres., A. H. Stone, treas., John N. Akarman, supt., Worcester Consolidated Street Railway Co.

Warren, Mass.—M. S. Myrick, pres., C. A. Richardson, director, C. A. Jefts, supt., Warren, Brookfield & Spencer Railway Co.

West Haven, Conn.—Israel A. Kelsey, gen. man., Albert E. Pond, supt., Winchester Avenue Railroad Co.

York, Pa.—W. H. Lanius, pres., Charles H. Mayer, treas., York Street Railway Co.

Youngstown, Ohio.—A. A. Anderson, gen. man., Mahoning Valley Railway Co.

Convention of Street Railway Accountants.

The Street Railway Accountants' Association of America held their annual meeting in Boston, September 6-9, contemporaneously with that of the Street Railway Association. The President, H. L. Wilson, in his annual address spoke of the importance of the auditing department in the management of any street railway company's business, and referred in terms of commendation to the work his Association's committee had done toward establishing a standard system of accounts and statistical work, seeking and following out suggestions from many organizations and corporations regarding their methods, and shaping these into a simple yet comprehensive form for the benefit of the Association. He said that valuableinformation had been secured and a system which is comprehensive and of broad scope to be applied to the business of large or small street railway companies had been the careful study of the committee. He said that the membership of the Association is gaining in strength, and wide-spreading territory was being represented.

In the Secretary's report it was shown that the Association now embraces sixty-eight different street railway companies, representing various parts of the United States, and including Canada, Mexico and the Hawaiian Islands.

The papers read were principally on subjects connected with the auditor's vocation.

An Electric Foundry.

A special to the New York *Commercial* from Reading, Pa., says:

"The new electric appliances that run the Reading Car Wheel Works have been given a fair trial, and the results are more than satisfactory to the firm. This is the first electrical equipment ever installed in a foundry, and was introduced with the belief that it would be more economical in cost and much more convenient than steam. The current is taken from the Metropolitan Company's wires, and thus far the system has worked well. The system covers everything that steam can run and is very complete.

"Several times when the bottom of the cupola has been dropped the motor has been splashed with molten iron, but this occasioned no trouble. Motors run the elevator and the drop used for breaking old car wheels. This drop has a fall of 40 feet. The ladel carriers have a capacity of about 800 pounds to the floors. These ladels are operated by a small reversing motor which can be run by the man in charge of the large pouring ladel. The five-ton ladel is run by a motor in the rear. All the carriages over the tracks are operated by electric motors.

"All motors are specially built to stand a temperature of 150 degrees. They are equipped to reverse at varying speed. From each controller is run a hand rope to the floor, so that each molder has a perfect control of the speed and can vary it from one to fifty feet per minute on the hoist. Each hoisting motor has an electric brake. By electric power the red-hot car wheels are lifted from their molds and taken to the annealing pits. The system enables the men to work rapidly and at less cost than before. The tumbling barrels and pressure blowers are also run by motors."

There has been a great deal said in newspapers lately about the discontinuance of "The Lake Shore Limited," the New York Central's twenty-four hour train between New York and Chicago.

There is no truth in this rumor. "The Lake Shore Limited" will continue to run every day in the year over the New York Central & Hudson River, and Lake Shore & Michigan Southern Railroads—the same tracks that carried the Exposition Flyer, between New York and Chicago, in twenty hours, for 175 days during the World's Fair.

COMPARATIVE EARNINGS AND ECONOMY OF OPERATION BETWEEN SINGLE AND DOUBLE TRUCK CARS FOR CITY USE.*

BY RICHARD M'CULLOCH.

Before beginning a discussion of this subject, it would be well to define what is meant by single and double truck cars, as these terms are often very loosely used. In this paper a single-truck car will mean one in which the body rests upon a truck, the axles of which are parallel with one another, and at all times perpendicular to the center line of the car. In a double-truck car the body is pivoted upon two independent trucks, each of which swings underneath the body with perfect freedom.

Double trucks for electric cars are of comparatively recent adoption. All of the early electric cars were equipped with single trucks, and in this horse car and cable car practice was followed. As the single truck was first on the ground, and at present largely has possession of the field, it will be assumed that in this case of the double truck versus the single truck, the double truck is the plaintiff and must submit the weight of the evidence.

Double trucks were first applied to cars in the desire to use longer bodies than had been customary. In the use of a single truck the best practice has been to limit the wheel base to about 7 ft., as a greater distance than this would cause the wheels to bind in curves. Assuming that the body of the car is 20 ft. long and that the platforms project 4 ft. beyond the body, the end of the platform would overhang the axle 10.5 ft. This is as great an overhanging as is customary, although single-truck cars have been built with bodies longer than 20 ft. In this case it is necessary to provide extension springs on the trucks to check the oscillation of the car body. With a very long car body, however, the oscillation is not entirely overcome by this device, and the rocking becomes very disagreeable to passengers and very disastrous to the car and track. Twenty-two feet may be arbitrarily established as the limiting length of the body of a single-truck car, and if we wish to use car bodies longer than this, we must adopt some truck which will avoid oscillation, and which will pass around curves without undue use of power. The double truck accomplishes this, and it was to enable longer bodies to be used that it first came into use.

The truck which was first used for long street railway cars was an adaptation of that used by the steam railroads. This truck contains four wheels of equal size and is pivoted over the center. It was soon discovered that for street railway uses this form of truck had two very objectionable features, first, that the floor of the car must be high enough above the rail to allow the wheels to swing freely under the car, and secondly, the motor being geared to one axle of the truck, only 50 per cent. of the weight of the car was available for traction. The latter is a serious objection on roads having grades.

From what has been said it will appear that the single truck is the truck for short cars, and the double truck is the truck for long cars. Therefore, a discussion of the relative merits of these two types of trucks will involve a discussion as to the relative merits of short and long cars. Also, as it is customary to supply long cars with cross seats and short cars with longitudinal seats, we have instead of the comparatively simple subject of single trucks versus double trucks, which has been assigned to your committee, the more complicated struggle between the short car with single trucks and longitudinal seats, and the long car with double trucks and cross seats.

It will be assumed in the discussion which follows that the road possesses the characteristic city travel (a load curve of which was shown).

* Read at the Convention of the American Street Railway Association, Boston, Sept. 6-9, 1898.

It will be noted that two very pronounced peaks occur in this load curve, one in the morning from six to nine and the other in the evening from five to seven. It is at these times that the capacity of everything is tried. While the load curves of all city roads resemble each other, it is evident that local conditions will to a large extent determine the kind of car which the railroad company will operate. Some of these local conditions are the class of people who constitute the passengers, the location of the road with reference to the established lines of travel, the amount of pleasure travel received by the road, and the keenness of competition with other roads. The last is an important condition, because a road is sometimes forced to adopt certain measures for its protection which it would not adopt under any other consideration. In this discussion we will assume that it is to the interest of the road, even if no immediate competition exists, to use all reasonable endeavors to please its patrons, because this policy will render the road more ready to meet competition when it arrives.

Before the advent of the electric car, the horse car had become such an established institution in this country that certain standards as to track and rolling stock had become fixed. In the matter of rolling stock, the size of the car had always been limited by the ability of two horses to draw it. When a mechanical motive power replaced the horses this limit disappeared, and almost the first improvement made in rolling stock was to increase the size of car bodies. Instead of bodies 16 ft. long, electric cars were built with bodies 20 ft. long, and now this length is being increased to 28 ft. and 30 ft.

The expense of the average city road may be divided up as follows:

Maintenance of way and structures	4 per cent.
Maintenance of equipment	7 per cent.
Conducting transportation	52 per cent.
General expense	8 per cent.
Fixed charges	29 per cent.

It will be noticed that the item "conducting transportation" is more than one-half of the total. This is largely made up of the wages of conductors and motormen, and is proportional to the number of cars operated. Hence it follows that if we may by the operation of larger cars cut down the number of cars, this account may be reduced in nearly the same ratio as the size of the car is increased. There are many other reasons why the size of the cars has been increased, such as the increased volume of traffic due to the higher speed and enlarged territory of the street railroads, the greater comfort demanded by the traveling public, the increased power available for the operation of cars, etc., but it is probable that the present tendency toward the increased size of car bodies is with a view of operating larger units and fewer of them.

A line operating small cars seating twenty-eight persons on a headway of $3\frac{1}{2}$ minutes would give the same service from a standpoint of seating capacity if it operated large cars seating forty persons on a headway of five minutes. Manifestly, this latter service would be preferable from the railroad standpoint for the reason just given, and the question is, would the service be equally acceptable to the passenger? In this comparison we are assuming that the larger car is the more desirable vehicle in which to ride. Would the pleasure of the ride compensate the passenger for the greater length of time which he would have to wait? This is a question which must be solved by each manager for his particular road, as its correct solution depends largely upon local conditions over which he has no control. The scrutiny with which a passenger chooses a street car varies with the length of his proposed ride. If the ride is to be short, he takes the nearest car without reference to comfort; but if he is to ride a long distance, he will walk past several lines in order to choose that one on which he will have the most pleasant ride. The car question then becomes a more serious one with long roads and with roads catering to a pleasure traffic. It has usually been accepted that on those having a purely business traffic the proper car is the short one operated on short headway. The author, however, is of the opinion that even in this case the long car operated upon somewhat longer intervals would be desirable. It has often been observed that where a line operates two sets of cars a passenger will allow several cars to pass him in order to patronize that type of car which suits him best. This has been observed even in the busy hours of night and morning when it would be fair to assume that passengers would be hurried and likely to take the first car which passes.

One of the most serious questions occurring in street railway practice is the problem of how to take care of the rush travel which comes morning and evening. With our present methods there are only two ways of taking care of this travel: the first, by increasing the number of cars or units in service; and the second, by increasing the capacity of each unit. The latter method consists of attaching a trailer to the motor car, and where this is done it is usual, also, to increase the number of units in service. On first thought there would seem to be no better method of increasing the capacity of the road than by the use of trail cars. They are easily attached and detached; they are in service only when necessary, and they do not require the assistance of additional trainmen. An examination of the trailer system, however, will reveal the fact that it possesses serious defects. The trailer is not automobile, and requires the services of men and horses to attach it to the cars and to move it between the car sheds and the motor cars. The opening between the motor and trail car increases the danger of accident to both passengers and conductors. The number of entrances and exits is increased, and this augments the work of the conductor in keeping track of his fares and increases the danger of his missing some of them. If an extra conductor is placed on the trailer to collect fares, a great portion of the gain due to the trailer system is lost. The use of trailers throws an additional strain on the motors, as a heavy weight is added to the train which is not available for traction. The trouble is intensified as the load on the trailer increases; it makes the train more unwieldy in handling, and is largely responsible for the difficulty in starting and stopping quickly and in making schedule time.

To obviate the necessity of using trailers, a large car equal in seating capacity to the combined capacity of the motor and trail car may be operated. This system, however, introduces the disadvantage of the operation at all times of the day of a seating capacity needed only during a few hours of the day. It also increases the size and weight of the cars and the average power required to operate them.

In order to compare the relative economies of single and double truck cars, their advantages and disadvantages will be discussed with reference to the following points:

1. Wear and tear on trucks.
2. Wear and tear on motors.
3. Power required.
4. Wear and tear on track.
5. The use of trailers.
6. The seating arrangements and convenience of exit and entrance.
7. The preferences of passengers.

These relations will, as far as possible, be reduced to a money basis, and in order to do so a comparison will be instituted between a road which operates double-truck cars and one operating single-truck cars using trailers 26 per cent. of the time to take care of the heavy night and morning travel.

The bodies of the double-truck cars are 26 ft. in length and contain eighteen cross seats, seating 36 passengers. The trucks are of the maximum traction type; the empty car weighs 23,500 lbs., and the motors are G. E. 800.

The single-truck car has a body 20 ft. in length;

it is equipped with longitudinal seats and the entire car weighs 16,000 lbs. It will seat 28 passengers. During the period of heavy travel, which amounts to 26 per cent. of the time, trailers are attached to these motor cars. Open trailers are operated in the summer months and closed trailers during the winter. The average seating capacity of the unit, estimating the trailer as a part of the car during the time that it is operated, is 35 seats, which approximates the seating capacity of the double truck cars very closely. The motors in use on the single-truck cars are W. P. 50.

The number of cars operated is obtained by dividing the daily car mileage by 115. It is necessary to do this because the average mileage per car on the two roads is different. The comparison is thus between 70 single-truck cars and 47 double-truck cars, each car making 115 miles per day. The road operating the double-truck cars has the greater density of traffic.

WEAR AND TEAR ON TRUCKS.

It is evident that since a car equipped with double trucks has eight wheels and one equipped with single trucks has four, the former will be more expensive to supply with wheels. Table I shows the comparative replacement and cost of wheels and brake shoes on the two roads for one year. Table II shows the comparative cost of maintenance and repairs of trucks and motors for two years. It will be noted that while the cost per car is much greater on the road using double trucks the cost per passenger is almost the same. It would not be fair to assume from these figures that the cost of maintenance of trucks and motors per passenger is always the same no matter what sort of truck is used, because these figures result largely from the fact that in this particular case the double-truck car carries the greater number of passengers, but an inspection of the table will emphasize the advantage of the large unit as compared with the small one. It will be seen by reference to Table I that the greater part of the increased expense of maintaining the double-truck is due to the renewals of wheels and brake shoes.

In examining the relative strength of the various parts of trucks the side pieces may be compared to a beam supported at two points and carrying a concentrated load. The deflection of such a beam is proportional to the third power of the span, and in the analogy the span corresponds to the wheel base of the truck. Therefore, the shorter the wheel base the stiffer the truck side, and in view of its long wheel bases it is evident that the single truck is at a disadvantage in this respect. For instance, a truck side where the wheel base is 4 ft. 6 in., is 3.76 times stiffer than a truck side of equal section where the wheel base is 7 ft.

WEAR AND TEAR ON MOTORS.

Table II, to which reference has been made, gives the comparative expense of inspecting, repairing and maintaining the motors of double and single truck cars. As in the case of the trucks, it will be noted that while the expense per car is much greater in the case of the double-truck car, the expense per passenger is nearly the same.

Table IV gives the relative weights carried by the different cars, when empty, seats full and car crowded. It will be noted that while the percentage of weight available for traction in the case of the maximum traction truck remains constant, in the case of the motor and trailer it falls off as the number of passengers increases, and is especially small if the trailer is proportionately more heavily loaded than the motor car.

POWER REQUIRED.

Table III gives the power required to operate the different cars, and is the average of a long series of wattmeter tests. In making these tests the wattmeter was placed on a car in actual service and allowed to remain through the entire day. An examination of the tables will reveal the fact that the power required for the propulsion of the car and the care and repairs which the motors demand are much greater in the case of the double-truck car. But if the number of passengers be taken into account, it is seen that the power and the cost of maintenance are roughly proportional to the number of passengers carried with either style of truck.

WEAR AND TEAR ON TRACK.

The wear of the rails of a street railway track is due to the grinding action of the wheel on the rail, and this is proportional to the weight on the wheel, but is intensified by the dirt on the rail, which causes the wheel to slip and act as an abrasive agent after the slipping has begun. The weak point of a street railway track, however, consists of the joints and the opening in the special work. The energy of the blow which the wheel strikes as it passes a low joint or a crossing is equal to the product of the weight of the wheel and the height of the drop. Therefore, on any given track both the wearing action of the wheel and the destructive action of the wheel are proportional to the weight which rests upon it. If the number of wheels under a car be increased, the number of blows which a low joint receives is also increased, but the intensity of each blow is diminished. Double trucks are at no disadvantage as compared with single trucks in this respect, unless the weight of the car be increased. Due to the shorter wheel base, double trucks go around sharper curves and go around the same curve with less output of power and less wear on the rail than single trucks. The double truck fell into disrepute when the maximum traction truck was first exploited, on account of its liability to leave the track. This was due to the small amount of weight which was placed on the small wheels. It is now customary to place 30 per cent. of the weight on the small wheels, and with track in fairly good condition, no difficulty is encountered in keeping cars on the track.

THE USE OF TRAILERS.

In the case of the two roads under discussion, the road operating single-truck cars attaches trail cars to the motor car for two trips in the morning and two trips in the afternoon. For the entire year trailers were operated on 26 per cent. of the trips. Allusion has already been made to the use of trailers. The advantage of the trailer on this particular road arises from the fact that the load peaks are unusually sharp. The use of the trailer increases the capacity of each unit during the heavy hours of morning and evening travel and during rush hours due to base-

TABLE I.

Comparison of the cost of wheels and brake shoes on double and single truck cars for the year 1897.

	Average number wheels used per car per year.			Cost per car per year.				Total cost per car per year per 1,000 passengers.	Wheel mileage.	
	33″	30″ trailer.	24″	Wheels.	Labor in replacing.	Brake shoes.	Total.		33″	24″
Double truck cars (47)......	8.72	......	7.06	$77.92	$17.36	$11.70	$106.98	$0.47	17260	20916
Single truck cars (70)......	6.26	1.00	......	40.43	7.99	4.80	53.22	0.38	25329	......

The double truck car has four 33-in. wheels, four 24-in. wheels and eight brake shoes. The single truck car has four 33-in. wheels and four brake shoes. Average daily car mileage—115.

TABLE II.

Comparison of the cost of repairs and maintenance of trucks and motors on double and single truck cars for the years 1896 and 1897.

	Average passengers per car per year.	Truck repairs.		Motor repairs.		Total.	
		Per car per year.	Per car per year per 1000 passengers.	Per car per year.	Per car per year per 1000 passengers.	Per car per year.	Per car per year per 1000 passengers.
Double truck cars (47)......	226,000	$181.00	$0.80	$319.00	$1.41	$500	$2.21
Single truck cars (70)......	141,000	110.00	0.78	196.00	1.39	306	2.17

G. E. 800 motors on double truck cars. W. B. 50 motors on single truck cars.

TABLE III.

Comparison of the power required by double truck and single truck cars.

	Average watts.	Average watt-hours per car mile	Average speed miles per hour.	Average watts per seat capacity.	Average watts per ton, car empty.	Average watt-hours per car mile per 1000 passengers.
Double truck car—seats 36, weight 11.75 tons.						
Average for the entire day	12040	1334	9.03	335	1025	5.9
Average for the heaviest trip	13080	1412	9.25	335	1025	......
Single truck car—no trailer, seats 28, weight 8 tons	8471	921	9.20	3.3	1060	......
Single truck car—trailers operated 26 per cent. of the time.						
Average for the entire day	9400	1110	8.42	254	1088	7.9
Single truck motor and open trailer—seats 63, weight 10.5 tons.						
Average for the heaviest trip	12680	1410	8.84	201	1208	......

TABLE IV.

Comparison of weights carried by single and double truck cars.

	Number of seats.	Total crowded capacity.	Weight empty.	Percentage of weight on driving wheels.			Pounds weight per cent.			Pounds weight per unit of total capacity.		
				Car empty.	Seats full.	Car crowded.	Car empty.	Seats full.	Car crowded.	Car empty.	Seats full.	Car crowded.
Single truck motor car........	28	80	16000	100	100	100	572	702	943	200	246	330
Single truck motor car with open trailer........	63	140	21000	76	67	67	334	463	622	170	210	280
Single truck motor car with closed trailer........	48	125	21000	76	72	71	438	568	776	168	218	298
Double track car........	36	1.0	23500	70	70	70	653	782	1,050	214	258	344

Each passenger is estimated at 130 pounds.

ball games and races. On this particular road the motormen and conductors are paid ten cents per trip extra for all trips where a trailer is attached to the motor car. This expense largely offsets the value of this arrangement. There is no question but that the use of the trail car increases the number of accidents, for two reasons: first, because the trailer is another car, and second, because the opening between the motor and trail car is a dangerous one for a passenger boarding or alighting from the car. It is impossible to estimate the money value of this accident liability, because in the case of many accidents it is difficult to determine what proportion of the damage was due to the trailer. Trailers must be switched at the ends of the roads and at the car sheds and require men and horses for this purpose. The use of trailers also entails other expenses, such as car heating, cleaning, repairing and car license, which should be charged against the trail car system. To counterbalance all these disadvantages, the only advantage which the trail car system possesses is its flexibility.

THE SEATING ARRANGEMENTS, EXITS AND ENTRANCES.

As has already been stated, the cross-seat is used almost so universally in connection with the double-truck car that it is fair to consider the economy and efficiency of cross-seats and longitudinal seats in connection with the discussion. There is no doubt that the cross-seat is preferable from the passenger's standpoint, and the reasons for this preference are not difficult to analyze. Passengers often travel in pairs, and the cross seat gives a privacy to their conversation which is not possible with the longitudinal seat, the jerks due to the stopping and starting of the car are less disturbing to the passenger when he is seated facing the direction of motion, and the cross-seat renders it easier to look out of the windows.

If two car bodies of the same size are taken and cross-seats installed in one and longitudinal seats in the other, the car body equipped with the cross seats will have the narrower aisle. This induces two disadvantages in the cross-seat; one, that the crowded capacity of the car is less, and the other, that when the car is crowded the time consumed in loading and unloading is increased. The latter difficulty will be the more serious the shorter the haul and greater the number of stops.

In the early days of the double-truck car, it was customary to mount the body high enough so that the wheels would swing under it. This gave the car a very unsightly appearance and made it difficult of access. Three steps were necessary to reach the platform, and as these steps were steep, this form of car was particularly objectionable to ladies. By the use of the maximum traction truck with 33-in. wheels, however, it is possible to lower the floor to within 37 in. of the rail. By dropping the platform 8 in. below the floor of the car, it is possible to reach the platform by the use of a single step 14 in. above the rail. This renders the car as easy of access as the single-truck car. In the opinion of the writer, the fact that the car floor may be made so low in double-truck cars is the chief advantage of the maximum traction truck.

It has been attempted to facilitate the loading and unloading of large cars by providing exits and entrances other than the rear door. This practice, however, brings about what is perhaps a more serious disadvantage, as it gives the conductor more than one door to watch, renders it difficult for him to keep track of his fares, and increases the liability of his starting the car before a passenger is on or off.

THE PREFERENCE OF PASSENGERS.

The preference of passengers, to which allusion has already been made, is undoubtedly in favor of the double-truck car. In cities where the entire street railroad system is controlled by one company, this point may not be considered of value, because passengers are obliged to ride in whatever conveyance the company chooses to furnish. However, the experience of roads which have changed their rolling stock from small single-truck cars to large, comfortable double-truck cars, is that the travel has shown an immediate increase. Part of this increase has been drawn from parallel roads, but part has been a created traffic. As the accommodations increase, more people ride, and the regular patrons ride oftener. The street car ride instead of being regarded as a necessary evil, comes to be looked upon as a pleasant part of the shopping expedition, the visit, or the picnic. How great this created traffic will be depends upon the class of patrons served by the road and upon the terminal facilities of the line. The extremes of society, the very rich and the very poor, are not good riders, and it is probable that a road serving either of these classes entirely would get very little return for additional accommodations. The greatest increase would come from those who are now the best patrons of the street railroads, the fairly well-to-do middle class.

In this paper the writer has not attempted to prove that either the single truck or the double truck car is the better type. He has merely attempted to discuss the subject to bring out the strong points and the weak points of each type in such a way that the results may be applied to special and local conditions. Outside of the question of economy of operation, there are few roads on which the use of attractive, easy-riding, double-truck cars would not create travel, especially in the summer season. In a general way it may be stated that the single-truck car is more suitable for short hauls, dense traffic, many stops and low speed. On the other hand, the double-truck car is more suitable for long hauls, high speed, few stops and pleasure travel. In the existence of either extreme condition, it would not be difficult to decide which car to use. It is in dealing with intermediate conditions that the manager must use his judgment.

DISCUSSION.

Mr. McCormack (Brooklyn)—Mr. McCulloch states in the paper that with the use of double-truck cars it would be possible to lengthen out the headway. I wish to state that on our heavy lines we have had between three and four hundred double-truck cars and in not a single instance have we been able to lengthen out the headway. The double-truck cars increase the patronage to such an extent that we have had to shorten the headway. One thing more, and that is when it comes down to standing loads and moving crowds; yesterday (Labor Day) I noticed on the cars seating 40 passengers going to Coney Island that the average was 65 on the register. With a double-truck car, and a seating capacity of 60, it is nothing unusual to see 128 and 130 on the register, so you can see when you want to move large crowds what the difference is with the double-truck car compared with a single-truck car. There are 178 double-truck cars running in the service on one line and you can imagine what the travel is on that line.

Mr. Dimmock (Council Bluffs)—What is the headway?

Mr. McCormack—The headway on the Court street line, running from New York direct to Coney Island, is less than a minute. On the Third avenue line it is three minutes nearly all day, and part of the time two minutes. The headway from 65th street to Coney Island, where all the Coney Island cars converge, is about twenty seconds.

Mr. Sloan (Chicago)—The double-truck cars are certainly coming into practice and favor, and it seems to me the main question is the question of traction. I have had no experience with double-truck cars, and I would like to know whether anyone who has had experience with them knows anything about the motors, using four motors instead of two, to get the maximum traction. It is a subject we should know more about, because in the use of the double-truck cars we are replacing the two motors with four.

Mr. Beggs (Milwaukee)—I think Mr. McCulloch has so thoroughly presented the case that there is very little to be said upon it, particularly in behalf of the "plaintiff." I do not think that the writer of the paper evinced any partiality as between a single and double truck car; but it is very evident in what direction the sympathies of the writer of the paper lie. In the city of Milwaukee we have for three years been experimenting practically with the advantages and disadvantages of single and double truck cars. In 1896 there was put upon the system twenty double-truck cars with Maxim trucks. These cars were equipped with 18 double seats, seating 36 persons. A year ago, the early part of 1897, in view of our experience of a year in the use of the cars, we enlarged somewhat upon them, improved the trucks to some extent, we thought, by abandoning the Maxim truck and so building the frame of the car as to in that way obviate what had been with us a very serious difficulty, namely, the forward wheels leaving the rail. We use 30-inch wheels to accomplish it. We increase the length of the car and seat 40 passengers by placing in double seats. During the present year we have been benefited by our experience still further, and increased the length of the car, that is, the body, and enlarged the seating capacity without at all increasing the overall length, which is 41 feet over bumpers, and maintain virtually the same size of platform so far as the accommodation to passengers is concerned, in crowds, by increasing the length of the body one foot, slightly moving the seats together and reducing the amount of the bumper in front of the dash; so that with our present car, so far as our service is concerned, there is little left to be improved upon. We seat 44 passengers, having 22 double seats.

Of course the question as to the use of the double-truck car is determined by local conditions. Our double-truck cars, for the climate of Milwaukee, are to a great extent a necessity. Because of the large open spaces and our short summer season, it is almost impracticable to maintain the duplicate equipment necessary for summer and winter services. I do not know anyone now in the service of the company who has not been converted to the use of the double-truck car, and we have arrived at a standard. There are many reasons existing for the adoption of a standard car with us—the short summer season, the likelihood of chilling winds coming up and cold rains at any time in the warmest days of summer. We now have a car that suits us twelve months in the year. We have not had any difficulty with the matter of traction. We use a 33-inch wheel in the equipment we are having built and still maintain only a distance of 32 inches from the rail to the bottom of the sill; and that was one of the difficulties we had to overcome. We did that by giving considerable attention to the matter of the construction and framing of the car to permit the 33-inch wheel to readily pass around our shortest curves. We are so thoroughly convinced as to the advantages of the double-truck car that we are gradually permitting all our single-truck cars to be worn out and scrapped as their life is brought to an end.

We have found that the use of the double-truck cars has greatly increased the traffic; in other words, the people would wait for double-truck cars on certain lines. We are compelled to place some of the single equipment on at times, but the people still wait on the streets where the two types of cars are run on the same lines for the double-truck car, for the reason that the riding is much more comfortable. The double-truck cars on our lines ride almost as smooth as a Pullman sleeper. That, of course, depends largely on the character of the track; but on a large portion of our lines, particularly on those lines where we are putting on the heavy equipment, we are having the connection between the rails cast-

welded at the joints, and we are doing away with the rocking and pitching motion of the car, and are enabled by the use of the double-truck to make much higher speed, and that is the tendency of roads all over the country. We have to make higher speeds. We brought our average up within two years certainly a mile an hour. Our average speed now is somewhat in excess of nine miles per hour. We would not be able to do that with a single-truck car, because of the oscillating motion and the liability of the pitching to displace the trolley wheel, whereas with the double-truck cars we seldom have such an experience.

As to the matter of wear and tear, we believe the weight of evidence is in favor of the double-truck car. While we have double the number of trucks and double the number of wheels to maintain, the blow on the wheel at crossings and special work is so much easier that it does not wear the tracks nearly so much, and we find that our repairs of springs is possibly 75 per cent. less on the double-truck cars than on the single-truck cars. We have been able on our lines—and I, of course, recognize the difference of conditions between Greater New York and our less populous cities—been able to increase our headway on most of the lines on which we have placed double-truck cars. In other words, we try to regulate the headway of the double-truck cars to meet the general conditions during the larger portion of the day, and during the rush hours of the morning and evening, particularly in the evening, we either shorten the headway one-half or throw in intermediate cars, but still maintaining the regular headway of the regular equipment of the line; so that, so far as the city of Milwaukee is concerned, we are very strongly impressed with the very great advantages of the double-truck car, many of which have been referred to indirectly in Mr. McCulloch's able presentation of the case; and we experience other advantages, which are governed by local conditions, and would not apply, possibly, in all cities even of the same population.

A question was asked as to the four motor equipment. I might say that during the present year we have had ten interurban cars constructed, running between Milwaukee and Waukesha Beach and the city of Waukesha, a distance of 26 miles, or slightly in excess. These cars were carefully constructed after complete investigation and the possession of all information we could get from electrical engineers; and based on this and our own experience and judgment, we have equipped them with four 1,000 motors, geared to make 26 miles per hour, weighted with 40,000 pounds. Our double-truck cars are possibly the heaviest in use anywhere in the United States. They weigh about 35,000 pounds. With these four motor equipments we have no trouble from lack of traction whatever, and we are beginning to believe that in the very near future it will be advantageous for us to equip all the double cars with four motors. We have some grades we are climbing with our double truck cars, 33-inch wheels, running up as high as 6 and 7 per cent. They do it with a little difficulty at certain times—certain conditions of rail and weather—but with our four motor equipments we usually have no difficulty whatever in climbing the grades, and in getting, we believe, very superior service.

I think, Mr. Chairman, that the case of the plaintiff, which Mr. McCulloch has been pleased to term the double-truck car, was so ably presented in his paper that it does not need any other advocate for it, but I should rather have denominated the double-truck car the defendant, because there have been so many attacks made upon it. I can only say, so far as we in the city of Milwaukee are concerned, that the double-truck car has come to stay. The character of the population you are serving has much to do with the discrimination that is shown in the selection of a car to ride in. Some sections of the city do not pay much attention to it, and there are other sections that discriminate, and just as you please the pleasure and comfort of the riders we find the traffic increases on those lines. We have what we might call a mechanic district in our city which uses our Third street line, which was equipped during the present year, and there is a marked increase on that line. I might say, as indicating the economy of the double truck, that on certain lines equipped two years ago with double-truck cars we had previously maintained a headway of four and a-half minutes, and by the use of the double-truck car, and the greater speed obtained, together with the greater number of passengers accommodated on this line, running through the better portions of the city, we have been able to gradually lengthen out the headway to six minutes without any complaint from our patrons. You can readily understand what that means in reduced equipment. Quite recently, within the last three months, by a further increase in the speed, on a long line—our policy is to run long lines from one extreme of the city to the other, for the comfort of the passengers and to avoid transfers—we have recently cut off another car and still maintain the headway at six minutes by increasing the speed and making the trip in 90 minutes instead of 96 minutes. I might say that in the same way on the Third street line, the line last equipped, we hope by the increased speed that we will be able to maintain by the use of these double-truck cars over the oscillating single-truck cars, we will be able to take off two of the 16 cars on the line and reduce the number to 14. This is one of the very great economies which we are realizing throughout the system by the use of these double-truck cars. We are able to run at very high speeds on our line from Milwaukee to Waukesha with the double-truck cars, whereas with a single-truck car it would be hazardous to run the car at such speeds, and they could not be kept on the track. The experience of the city of Milwaukee is strongly in favor of the double-truck car. The latest improved truck permits us to use the 33-inch wheel with the same facility as the 30-inch wheel, no greater height from the rail; and I think as soon as our necessities are known the manufacturers of trucks and cars will accommodate themselves to the new conditions and many obstacles will be overcome.

Mr. Bean (St. Joseph)—I move that the report be received and spread upon the minutes and a vote of thanks extended to Mr. McCulloch for his able paper.

Carried.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING PLANTS.

Albion, N. Y.—The property of the Albion Electric Company has been formally transferred to the new electric light company, whose capital stock is $50,000. J. H. Rollins, superintendent of the old company, will serve the new one in the same position. The old plant is to be used until the 400 horse-power plant at Waterport is installed.

Erie, Pa.—Application has been made for a charter by the Erie County Electric Company which proposes to produce electricity for heat, light and power. The incorporators of the company are William C. Readio, William E. Brown, William S. Carroll, William G. Reed and Fred Einfeldt.

Geneva, Switzerland.—The great electric works in this city which supplied light and motive power to the whole canton were destroyed by fire on the night of the 7th inst.

Henrietta, Tex.—E. B. Carver is reported to be interested in a company which is to be organized, with a capital stock of $6,000, for the erection of an electric light plant.

Kokomo, Ind.—Charles Willitts of this city has been appointed receiver of the Citizens' Light & Power Company. The company is capitalized at $75,000. It had a contract for street lighting at $70 per lamp.

Little Falls, Minn.—The city council has ordered a special election for October 4 to enable the people to vote on the question of issuing $60,000 of bonds to purchase the present waterworks and electric light plants, or construct a new plant if the corporation owning the plants refuse to sell.

Montpelier, Vt.—The stockholders of the Consolidated Lighting Company have voted to ratify the action of the directors regarding the acquirement and purchase of the Bolton water power. A resolution was also passed, retiring and cancelling all the preferred stock in the treasury, some 1,250 shares, and to increase the capital stock of the company to $91,349 by issuing 2,784 shares of common stock at $10 each.

Thibodaux, La.—An ordinance will be submitted to the voters of this town at the November election providing for the establishment of an electric light plant.

Wayne, Neb.—The city council has awarded the contract for putting in a complete electric light plant to the John R. Burke Electric Supply Company of Omaha. The plant is to be completed and in perfect running order in ninety days.

Westerville, O.—The city council has passed an ordinance granting a ten-year franchise to the firm of Bennett & Arick, who constitute the Westerville Electric Light Company. A contract for electrically lighting the city for five years will be given the company.

West Superior, Wis.—The council has decided to award the city lighting contract to the Superior Water, Light & Power Company, the company having agreed to furnish lights at the same price that Mr. Burgess did in his proposition, which the council had already accepted. The basis for the contract is $80 per light of 2,000 candle power.

Winona, Miss.—The Blackston Mercantile Company may be addressed concerning the establishment of an electric light plant.

Wichita, Kan.—There is not now an electric light burning in the streets of Wichita at night. The light company notified the city officials that on September 1 the rate would be increased from $6 per arc light per month to $7. The council ordered all lights off the streets and steps are being taken to get a new plant. [After the above was in type we learned that the company had agreed to furnish lights at the old price.—ED.]

STREET RAILWAYS.

Albany, N. Y.—A certificate of consolidation of the Buffalo, Tonawanda & Niagara Railroad Company and the Tonawanda Electric Railroad Company has been filed with the Secretary of State. The consolidated roads will be known as the Buffalo, Tonawanda & Niagara Falls Electric Railroad Company. The capital stock of the new corporation is $1,500,000, and its directors are Henry B. Smith and H. M. Gillett of Bay City, Mich.; T. E. Ellsworth of Lockport; George Sandrock, James A. Roberts and C. M. Howard of Buffalo; James Low of Niagara Falls, and J. A. Read and B. S. Rand of North Tonawanda, N. Y.

Bennington, Vt.—The Bennington & Woodford Electric Railroad was closed to passenger traffic for the season on the 6th. The road, which runs up among the mountains nine miles northeast of Bennington, is used only for summer business. The road has had a successful season.

Chippewa Falls, Wis.—Eau Claire and Chippewa Falls are now connected by an electric street railway. The line was opened on the 2d inst. It is owned by the Chippewa Falls Railroad Company.

Cohoes, N. Y.—The worst disaster in the history of trolley roads occurred in this city on the night of the 5th inst. An express train of the Delaware & Hudson Railroad Company dashed at almost full speed into a car of the Troy City Railway Company which was full of passengers, totally demolishing the car, killing eighteen persons outright and fatally wounding ten others, several of whom have since died. Among the seriously injured was the motorman of the trolley car.

Detroit, Mich.—The Detroit, Lake Shore & Mt. Clemens Electric Railway Company celebrated the opening of their road on the 1st inst. by an excursion over the line and a "sumptuous supper" at McSweeney's. The cars of the company are described as things of beauty, the woodwork being of a rich selection of Cuban birch, and the reversible seats handsomely upholstered in old gold plush. Several innovations in suburban cars are introduced, such as smoking apartments and drawing rooms for private parties, which latter are equipped with individual leather upholstered chairs. All the latest improved appliances in connection with the motive power are introduced. The carbon-electric headlight is the most powerful known, throwing a searching ray for several blocks. W. J. Hart is general superintendent of the road.

La Crosse, Wis.—A new company, to be named the La Crosse & Black River Valley Electric Railway Company, is to be organized and have its headquarters in this city. The proposed route for the road will take it through the villages of Grand Crossing, Onalaska, Holmen, Stevenstown, Burr Oak, East Melrose, Putnam's, Pine Hill and Black River Falls. The line would be over 46 miles in length.

Mobile, Ala.—The two street railroad companies of Mobile employ 300 white men whose average pay is $1 60 per day. Both companies have complete shops for the repair and manufacture of cars. During the past year the Mobile Street Railroad Company has constructed a number of very handsome trolley cars. The annual pay roll of this company amounts to $50,000.

New Brunswick, N. J.—A report has reached here that the Brunswick Traction Company has assumed full control of the trolley line from Bound Brook to

Raritan, the transfer by the New York & Philadelphia Traction Company having been completed. The Brunswick Traction Company will operate the line.

Needham, Mass.—A corporation, to be known as the Needham & Boston Street Railway Company, is being formed here for the purpose of constructing and operating a street railway between Needham and West Roxbury.

New York.—The Broadway cable lines are to be changed at once to the underground trolley system. Work has already begun on the conduits on lower Broadway.—It is stated that the Union Railway Company has contracted to purchase the Yonkers Electric Railway, and beginning this week passengers will be carried from any part of Mt. Vernon to any part of Yonkers for a single fare of five cents. As soon as permission is granted to lay tracks across the Harlem Railroad and the line in New Rochelle is completed, through cars will be run from Yonkers to New Rochelle for a single fare of five cents.

Oakland, Cal.—The city council has granted the Oakland Railroad Company permission to use electricity upon its San Pablo avenue line.

Rockford, Ill.—The City Railway Company and the Rockford Traction Company, which were to be consolidated in case a 25-year extension of franchise could be secured, have refused to accept the franchise offered them by the council, claiming that burdens were imposed which, if accepted, would make it impossible for the consolidated company to do business and live.

Wheeling, W. Va.—The Wheeling Railway and the Bellaire, Bridgeport & Martin's Ferry Railway companies have been consolidated and both systems will be under entire control of the Wheeling Railway Company which has also an option on the Moundsville & Wheeling road.

MANUFACTURING, ETC.

Boston.—The "News Bureau" of the 9th inst. says: "We understand that the Walker Company is running its works to the fullest capacity and that in view of the fact that its capital of $2,500,000 is not sufficient to care for the large business it is doing, its capital stock will soon be increased to an amount not yet decided upon. Such new stock will be taken by the directors of the company, which include R. P. Flower, A. N. Brady, J. W. Hinckley, Perry Belmont and others equally well known. The company is at present a close corporation, and it is the intention to keep it so for some time to come."

Brooklyn, N. Y.—The Willard third-rail system of electric traction is to be installed upon a two-mile section of the Long Island Railroad during the latter part of the present month, to give a practical demonstration of the effectiveness and safety of this system.

Cleveland, O.—The Walker Manufacturing Company has, it is stated, signed a $300,000 contract with the Brooklyn Heights Railroad Company of Brooklyn, N. Y. The Walker Company will make for it 600 motors and electrical equipments. The company is expected to deliver them within six months.

TRANSMISSION PLANTS.

Niagara Falls.—The fifth 5,000 horse power dynamo in the Buffalo avenue power house of the Niagara Falls Power Company was tested a few days ago and found to be in perfect condition. The great machine moved without a hitch of any kind.

PROPOSALS.

New York.—Proposals are invited for engines, generators, the electric wiring and fixtures, etc., for the new hospital buildings of the Manhattan State Hospital at Central Islip, the proposals to be delivered in person or sent by mail up to 4:30 P. M. September 22 to Hon. Henry E. Howland, president of the board of managers, No. 1 Madison avenue, New York City. At that number drawings and specifications may be consulted and blank forms of proposals obtained.

PERSONAL AND MISCELLANEA.

The New Orleans papers at hand report the resignation of Superintendent James B. Craven of the Edison Electric Light Company of that city.

Philip Gabler, electrician of the Bleecker Street Railroad, Utica, N. Y., succeeds Frank L. Everts as superintendent of the road, the latter having resigned.

Galen C. Moses of Bath, Me., has assigned for the benefit of his creditors to Symonds, Snow & Cook of Portland, the assignment covering property valued at $400,000. Mr. Moses has been interested in electric railroad building and has been regarded as one of the wealthiest men in Maine.

A feature of the exhibits at the Street Railway Convention at Boston that attracted much attention was a gigantic globe and map of the world, 24 feet in diameter, placed in the center of the lower hall, and towering up through the light shaft into the upper hall. This geographical enterprise was not so much for displaying new political possessions as for impressing the observer with the extensive field of a large electrical firm which builds street railroads in various places that were indicated on the map in the evening by small electric lights. The demonstrator pointed out with special pride an isolated spot in the south of Africa. A miniature electric railroad formed the equator of this globe.

Thomas Farrell, assistant engineer at the works of the Lockport Gas & Electric Light Company, Lockport, N. Y., was killed by an electric shock on the night of the 31st ult. He was noticed leaning heavily against a dynamo by one of the workmen, who went up to see what was the matter and took hold of him to pull him back. As he did so Farrell fell to the floor in a heap; life was extinct. It is supposed that he accidentally touched both poles of the machine, making a circuit which passed nearly 2,000 volts of electricity through his body, causing instantaneous death.

INCORPORATIONS.

The Universal Electric Company, Portland, Me.—Capital stock, $150,000.

The Peninsula Electric Light & Power Company of Houghton, Mich., has increased its capital from $150,000 to $200,000.

The Mill Creek Valley Street Railroad Company of Cincinnati, O., has increased its capital from $500,000 to $1,750,000.

The Westerville Electric Company, Westerville, O. Capital stock, $9,000. Incorporators: C. L. Bennett, R. B. Adams, H. E. Chinn, E. S. Aldrich, O. W. Aldrich.

The Buffalo Manufacturing Company, Buffalo, Wyo.—to manufacture flour and put up electric light works in Buffalo, Wyo. Incorporators: C. J. Hogerson, W. J. Thorn and E. D. Metcalf.

The Mitchell Electric Company, Portland, Me.—to manufacture and deal in electrical appliances. Capital stock, $150,000, of which $2 is paid in. President, Thomas H. McDonnell of Quincy; treasurer, William E. Pearson of Boston, Mass.

The Minneapolis & Champlin Suburban Railway Company, Minneapolis, Minn. Capital stock, $150,000. Incorporators: Emery W. Hill, Lorenzo L. C. Brooks, Collinwood Evans, Henry M. Norton, Fremont S. Woodbury, Clifford S. Staples and Anthony Chryst.

Articles of incorporation of the American Indies Company, with $18,000,000 capital, were filed with the Secretary of State of New Jersey at Trenton, N. J., on the 6th inst. The incorporators are Thomas Dolan, P. A. B. Widener and W. L. Elkins of Philadelphia; Thomas F. Ryan, Frederick P. Olcott, A. N. Brady, R. A. C. Smith, Henry D. Macdona, J. N. Ceballos, Guillermo de Zaldo, H. P. Booth and H. G. Runkle of New York. The company has a general charter authorizing it to build and operate electric plants, telegraph, telephone, steamship and railway lines, to conduct real estate and mining operations and to carry on business in a number of other branches.

ELECTRICAL PATENT RECORD.

Letters Patent Issued September 6, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

610,241. Collector for Electric Railroads. Fred S. Pearson, Boston, Mass. Filed March 31, 1897.
610,445. Electric Railroad. John C. Henry, Denver, Col. Filed June 30, 1898.
610,238. Car-Fender. Harry Lehrer, New York City. Filed May 20, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

610,350. Means for Supplying Electric Currents to Agricultural Machines. Hugo Foerster, Gorsdorf, Germany. Filed Jan. 8, 1896.
610,402. Electric Switch. Rudolf L. L. Hundhausen, Wilmersdorf, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Dec. 31, 1897.
610,406. Resistance and Contact Apparatus for Electric Currents. Henry Lyon, Glasgow, Scotland, assignor of one-half to the D. Stewart & Co., Limited, same place. Filed July 6, 1898.
610,413. Direct-Current Regulator. Frederick E. Ramsay, Walsenburg, Col. Filed Jan. 28, 1898.
610,509. Means for Controlling Voltage and Volume of Electrical Currents. Harry Williams, Cleveland, O., assignor to the Morrison Battery Company, same place. Filed Dec. 8, 1897.

ELECTRIC ELEVATORS.

610,197. Controlling Device for Electric Elevators. Norton P. Otis and Rudolph Smith, Yonkers, N. Y., assignors to the Otis Brothers & Company, New York City. Filed April 4, 1892.

TELEPHONE AND TELEGRAPH APPARATUS.

610,274. Telautograph. Leon O. McPherson, Highland Park, Ill., assignor to the Gray European Telautograph Company, Chicago, Ill. Filed March 13, 1897.
610,278. Telegram-Transmitter. Edward Porter, Sydney, New South Wales. Filed Sept. 4, 1897.
610,339. Telegraph-Tape. Frank Atherton, Paterson, N. J. Filed Nov. 12, 1897.
610,347. Telephone. William A. Drysdale, Philadelphia, Pa. Filed Sept. 17, 1897.
610,393. Telephone. Sydney S. Fisher, San Francisco, Cal. Filed Jan. 14, 1897.

MISCELLANEOUS.

610,190. Secondary Battery. George J. Miller, Kenton, O. Filed April 13, 1897.
610,214. Dental Engine. John D. Wilkens, Chicago, Ill., assignor to John N. Crouse, same place. Filed Oct. 11, 1895.
610,229. Electric Clock Train. Charles M. Crook, Elgin, Ill., assignor to Charles S. Burton, trustee, Oak Park, Ill. Filed April 29, 1897.
610,465. Explosive-Engine. Alexander Winton, Cleveland, O. Filed Sept. 18, 1897.
610,511. Miner's Safety-Lamp. William Best, Morley, England, assignor to the Ackroyd & Best, Limited, same place. Filed Dec. 23, 1897.

TELEPHONE AND TELEGRAPH.

Old Time Telegraphers' Meeting.

The greatest gathering of telegraphers since the civil war is now holding sessions at Omaha, Neb., as the meeting was set for three days beginning on the 13th and ending on the 15th inst. It is the annual meeting of the Old Time Telegraphers' Association and the United States Military Telegraph Corps, and the attendance is not confined to membership in the organizations named, but is augmented by hundreds of outside telegraphers. An Omaha dispatch states that a leading feature to be witnessed is the ascension of the great war balloons with telegraph and telephone attachments that were used at Santiago. At the Trans-Mississippi Exposition an Indian war dance has been specially arranged for the telegraphers, as a reminder of exciting experiences to operators who saw frontier service. Besides the Exposition attractions proper, the telegraphers will be treated to a grand concert by the Mexican National Band, an exploration of the Midway under the leadership of the president of the Old Time Telegraphers' Association, a reception at George W. Leininger's art gallery, one of the finest collections in America, visits to the packing houses, and a farewell banquet overlooking the grand court of the Exposition.

At the Merchants & Manufacturers' Board of Trade regular monthly meeting in New York on the evening of the 7th inst., R. M. Walters, chairman of the Committee on Telephone Legislation, urged that an aggressive campaign be made this fall in the interest of lower telephone rates in New York City, and the committee was asked to make a full report at the next meeting. Five members of the board were made a committee to prepare an address to be sent to the Republican and Democratic State Conventions requesting that a measure for lower telephone charges be incorporated in their platforms. The committee consists of R. M. Walters, Charles Heckman, E. R. Lyon, Francis O'Neill and E. J. Gavegen.

The E. H. Martin Telephone Company has completed a new copper circuit wire connecting Webster City with Marshalltown, Ia., and expects to reach Gowrie in a day or two. This company's exchange in Webster City was established only a few years ago by a young man of limited means, now it has 500 miles of wire and forty local stations outside of Webster City and 200 'phones in use in that city.

The Dakota Central Telephone Company has had a representative at Pierre, S.D., making arrangements to extend its line west from Wolsey. The system with its connections extends to all cities in the eastern portion of the State, and its connection with the line from Pierre to Rapid City will insure a telephone system for the whole State.

Chas. Boyce, for several years superintendent of equipment of the Michigan Bell Telephone Company, has accepted the management of the Citizens' Telephone Company of Grand Rapids. He is considered one of the most expert telephone men in the country and has invented several improvements and attachments.

The San Diego, Cal., *Sun* states that within three weeks the Sunset Telephone Company will have its line completed into Portland, Ore., a distance of 1,500 miles from San Diego, and this will make it the longest telephone line in the world.

The Mississippi Valley Telephone Company is pushing the laying of conduits in St. Paul, and the pole line to Minneapolis is being rapidly constructed.

The Lawrence Telephone Company has been organized at Iron City, Tenn., to construct a telephone system.

J. T. Alexander is about to establish a telephone exchange in Providence, Ky.

New Companies Incorporated.

The Citizens' Telephone Company, Edinburg, Ind. Capital stock, $1,500.

The Home Telephone Company, Woodruff, S. C. President, E. F. Pearson; secretary, L. H. Irby; treasurer, S. J. Workman.

The Silver Creek Telephone Company, Yazoo City, Miss. Capital stock, $1,000. Incorporators: R. M. Beaman, Smith & McDonnell, T. W. Fisher and others.

The Missouri & Illinois Telephone Company, Meyer, Ill.—to conduct a telephone business. Capital stock, $2,500. Incorporators: O. C. Clay, W. B. Henton, H. C. Chinn.

The Huntingdon County Telephone Company, which proposes to operate and maintain a telephone system in the counties of Huntingdon, Bedford, Blair, Centre, Fulton, Mifflin, Juniata and Perry, Pa., and to connect with other lines, was chartered at Harrisburg on the 2d inst. The system to be used is a new one. The capital stock is $2,500.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: cert. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed;* inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Sept 12:						
Albany Ry. Co	100	2,000,000	$1,750,000	1½ % Q., Feb. '98.	151	155
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	50	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Sept 12:						
Allentown & Lehigh Val. Trac. Co	.	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Sept 12:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	39	..
Baltimore, Md.—Sept 12:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '97.	71	72
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23⅜	23½
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—Sept 12:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	...	..
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	11	13
North Shore Traction Co.........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	77	77½
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	86¼	86¾
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	105	106
Boston Elevated R. R.	100	10,000,000			68½	69
Brooklyn N. Y.—Sept 12:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	59¾	59⅞
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	214	216
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	215	220
Kings County Elevated	....	4,750,000	4,750,000	....	4	6
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	..	40
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Sept 12:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	67	68
*Buffalo Railway Co	100	6,000,000	5,370,500	1 % Q. Dec., '97.	79¾	80½
Columbus O.—Sept 12:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	50	51
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Sept 12:						
Charleston City Ry. Co	50	100,000	100,000	8 % S., Jan., '97.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Sept 12:						
Chicago City Ry. Co	100	12,000,000	12,000,000	8 % Q., Dec. 31, 97.	280	286
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12½	18
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	8 % Q., Jan., 98.	223	228
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	94	95
jChicago West Div. Ry.......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Sept 12:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118	118¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Sept 12:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	38	40
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '97.	62½	63
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	68	72
Detroit, Mich.—Sept 12:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Sept 12:						
City Railway Co..............com.	100	1,500,000	1,470,600	1¼ % Q., Jan. 1, '98.	104	105
City Railway Co................pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	103

*Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Sept 12:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	--
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	--
Holyoke Mass.—Sept 12:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—Sept 12:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	--
Indianapolis, Ind—Sept 12:						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	25	26
Lancaster, Pa.—Sept 12:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	--
Lancaster & Col. Electric Ry	....	....	87,500	....	..	--
West End Street Railway	....	....	....	....	..	--
Louisville, Ky.—Sept 12:						
Louisville Ry....................com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	85	89
Louisville Ry.................5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	101	103
Minneapolis, Minn.—Sept 12:						
Twin City Rapid Transit..........com.	100	17,000,000	15,010,000	....	25	..
Twin City Rapid Transit....7 % pfd.	...	8,000,000	1,714,200	1¾ %. Jan., '98.	101	102
Montreal, Canada.—Sept 12						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	275¼	279
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	103⅛	104¾
Memphis, Tenn.—Sept 12:						
Memphis Street Railway Co	100	500,000	500,000	....	15	--
New Haven, Conn.—Sept 12:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—Sept 12:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	150	180
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	124
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	1	2
New Orleans Traction Co.........pfd.	100	2,500,000	2,500,000	....	5	8
aCrescent City RR..........guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	28½
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23	26
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	52½	55
New York—Sept 12:						
Central Crosstown RR	100	600,000	600,000	2½ % Q., July, '97.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Jan., '98.	150	160
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98	170	195
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¾ % Q., Jan., 98.	156⅞	157
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	32	34
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	216½	225
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98.	180	190
hEighth Avenue RR	100	1,000,000	1,000,000	....	346	355
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q., Feb., '98.	350	360
jNinth Avenue RR..........guar.	100	800,000	800,000	....	170	190
kSixth Avenue RR...........guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q. Feb., '98.	330	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., Jan., '98.	178	181
Third Avenue RR	100	12,000,000	10,000,000	2 % Q., Feb., '98.	170	175
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	60	64
*Union (Huckleberry) Ry	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Sept 12:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	50	51
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Sept 12:						
Allegheny Traction Co	50	500,000	500,000	....	..	50
oConsolidated Traction Co......com.	50	15,000,000	15,000,000	2 %, Jan., '96.	19¼	19½
Consolidated Traction Co.......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	55¾	56½
pCentral Traction Co	50	1,500,000	1,500,000	....	..	..
qCitizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	68⅛	64
rDuquesne Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	...
Pgh., Allegheny & Man. Trac. Co	50	3,000,000	‖2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry	25	3,000,000	3,000,000	½ %, Jan., '96.	28[illegible]	28¾
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 97.	..	..
Second Avenue Traction Co...com	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Sept 12						
Union Street Railway Co	100	$350,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass—Sept 12						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Sept 12:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Sept 12:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Sept 12:						
United Traction & Electric Co	100	8,000.000	8,000,000	¼ %, Jan. '98.	70	72
Philadelphia.—Sept 12:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98.	67½	..
*a*Fairmount Pk. & Had. Pass. Ry.	50	800,000	300,000	3 % Feb. 1, '98.	65½	66
Union Traction Co .... $12½ pd	50	30,000,000	29,930,450	....	19½	19⅝
*c*Electric Traction Co	50	....	8,297,920	....	71½	71½
*d*Citizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	315	..
*e*Frankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	392	..
*f*Lehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
*f*Lombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
*d*Second & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	263	...
*c*People's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
*g*Germantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135	136
*g*Green & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
*h*People's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
*h*People's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
*i*Philadelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	92¾	93
*j*Catherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
*i*Continental Pass. Ry.....guar..	50	1,000,000	‖580,000	$6 share—July, '98.	136½	..
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
*j*Philadelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	175	180
*j*Philadelphia & Gray's Fy. RR..	50	1,000,000	298,650	$3.50 share July '98	88	..
*j*Ridge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	288	300
*i*Philadelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
*j*17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
*j*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	275	...
*j*Union Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
*j*West Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	23C
Rochester, N. Y.—Sept 12:						
Rochester Railway Co	100	5,000,000	5,000,000	....	11¼	15
Reading, Pa.—Sept 12						
*j*Reading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	20
*k*City Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
*l*East Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Sept 12						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,100,000	1¼ % July, '98.	128	130
National Railway Co	..	2,500,000	2,479,000	1½ %, July, '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '93.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry..........com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	112	114
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	58	55
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Sept.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	106	107¾
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅞	54¼
Presidio & Ferries RR	100	1,000,000	550,000	....	8⅛	8½
Scranton, Pa—Sept 12:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
m Scranton & Carbondale Trac. Co..	100	500,000	500,000	....	14	18
m Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Sept 12:						
Springfield Consolidated Ry	100	750,000	750,000	....	....	11
Springfield O.—Sept 12:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—Sept 12:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—Sept 12:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	103⅛	104½
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	278½	279
Washington, D. C.—Sept 12:						
Belt Ry. Co	50	500,000	500,000		..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	73½	74
Columbia Ry. Co	50	400,000	400,000	6 % A.	..	75
Eckington & Soldiers' Home Ry	50	707,000	652,000		8	..
Georgetown & Tenallytown Ry	50	200,000	200,000		..	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	122	123
Worcester, Mass.—Sept 12:						
*Worcester Traction Co........com.	100	3,000,000	3,000,000		15½	17
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	93	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Sept 12:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation. Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
f Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Sept 12:						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., July, '98.	279½	280
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	...	75¼
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Feb. '98.	143	
New York.—Sept 12:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	96	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	107	109
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	170	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	44
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan.., '98.	..	75¼
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	113
*International Ocean Tel Co.guar6%	100	3,000,000	......	1½ % Q.	109	112
Mexican Telephone Co	100	2,000,000	......		..	.65
*New York & New Jersey Tel. Co.	100	5,000,000	8,728,000	1½ % Q., Jan., '98.	149½	150½
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	92	..
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	92⅞	93
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Sept 12:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	168½	173½
Chesapeake & Potomac Telep. Co..	100	.....	......	....	47	55
Chicago Telephone Co	100	.....	......	.....	212	..
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	132½	134
Empire & Bay States Telegraph Co.	...	......	......	....	72	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	76	77
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	112	115
Providence (R. I.) Teleph. Co	50	....	......	....	86	90
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Sept 12:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
General Electric Co..........com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	43¾	44
General Electric Co............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	99	100
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	8
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	30½	31
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., July, '98.	57½	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Sept 12:						
Edison Elec. Ill'g Co., New York..	100	9,138,000	7,988,000	....	131	134
*Edison Elec. Ill'g Co., Brooklyn..	100	4,000,000	4,000,000	1½ % Oct., '97.	122	124
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	21	23
General Electric Co...........com.	100	40,000,000	30,460,000	2 % Q., Aug , 1898.	43¾	41
General Electric Co............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	99	100
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co... ..pfd	..	......	......	....	..	..
Pittsburg, Pa.—Sept 12:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	130	140
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Sept 12:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	86¼	86¾
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	41½	42
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	..
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co..	10	6,500,000	550,000	$32500 dis. Jan. 11'97	18½	14
Southern Elec. Light & Power Co..	10	187,500	187,500	....	8	10
Miscellaneous.—Sept 12:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	32½	35
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	15
Eddy Electric Mfg. Co	25	......	......	....	....	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	120	..
Hartford (Conn.) Lt. & Power Co..	25	175,000	......	....	4½	10
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	175	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	83½	87
Rhode Island Elec. Protec. Co	100	......	......	....	118	125
Royal Elec. Co. (Montreal)	..	1,000,000	......	2% Q	*154	157
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	137⅜	188
Thomson-Houston Welding Co	100	......	......	8 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	100	110

*ex d

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Sept 12:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$8 per sh. Feb. 1, '98	85	87
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—Sept 12:						
Consolidated Electric Storage Co	...	......	....	....	18	20
Edison European	..	......	....	.....	1	3
Safety Car Heating & Lighting Co..	100	......	....	......	100	105
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	21	28
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	90	93
Philadelphia, Pa.—Sept 12:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1⅛	1½
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	18	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	75	76
Welsbach Light Co	5	525,100	......	....	58¼	58¾
Welsbach Light Co., Canada	5	500,000	......	....	..	2¼
Pittsburg, Pa.—Sept 12:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	115	..
Miscellaneous.—Sept 12:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	..	16
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	...	55
Billings & Spencer Co	25	......	......	....	30	37
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	80	85
Johns-Pratt Co	100	......	......	....	98	100
*Pratt & Whitney Co..........com.	100	......	......	....	..	..
*Pratt & Whitney Co............pfd	100	......	......	....	42	48
Stillwell-Bierce Co............com.	..	......	......	....	96	98
Stillwell-Bierce Co.............pfd.	..	......	......	2 % Sept. 1, '97.	107	109
Shultz Belting Co	100	500,000	......	....	60	[illegible]
St. Charles Car Co	..	......	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Sept 12, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	....
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*118½	....
‡Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
‡Troy City Railway Co..................1st 5s	....	....	......	......	*105	105½

†Interest guar. by Albany Ry. Co.
‡Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Sept 12, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	......
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	......
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	105¼	105¾
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	102½	104
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	117	118
City & Suburban Ry......1st mtg. g. 5s.	8,000,000	8,000,000	1922	J. & D.	115	115½
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	114¾	121
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	119⅝

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,879,000	8,702,000	1924	J. & D.	101½	101¾
West End Street Ry.........Deben. g. 5s.	8,000,000	8,000,000	1902	M. & N.	105	106
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry...........1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¼	102⅝
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	.....
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	104¼	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	8,781,200	1928	J. & J.	....	....
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	53¾	54
North Chicago St. RR........1st mtg. 5s.	8,171,000	8,171,000	1906	J. & J.	104	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	...	103
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	8,969,000	1928	M. & N.	106½	107
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	100¾
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	95⅝
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Sept 12, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	8,000,000	2,500,000	1922	J. & J.	103¾	104
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‡So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

† Assumed by the Cincin. St. Ry. Co.
‡$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	103¾	104
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	8,500,000	1,249,000	1913	M. & S.	103½	105
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	....	......
aEast Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	103	104¾
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	...	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked a.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	8,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	....
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 6	100,000	94,000	1909	M. & S.	102	......

New Orleans La.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR..........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR............1st mtg. 6s.	......	50,000	1899	M. & N.	101	.....
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	8,000,000	1943	J. & J.	76⅛	79
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	107	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	103⅛	104¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	350,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	105	110
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	......	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	108	.....
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	120⅝	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	107
Broadway & 7th Ave.........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111⅛	114
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface............2d mtg. 5s.	1,000,000	1,000,000	1905	......	104	105¼
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	......	......
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	105¾	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	....	101	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	110	111
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118⅛	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	800,000	1903	J. & J.	108½	104
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115½	116½
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	*102½
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	104	...
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115	117⅛
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	95	100
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	119	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1[illegible],500,000	1997	F. & A.	113	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	107	109
Second Avenue Ry.............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115⅛
South Ferry RR. Co..........1st mtg. 5s.	350,000	850,000	1919	......	113⅛	114
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124	1:5
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	....
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	114⅛
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	109	......

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.....................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Sept 12, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry...........1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry..................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901		....	....
People's Pass. Ry..................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry..................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	.....	1948		102	108
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry..............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...............Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	.....
West End Passenger Ry.........1st mtg. 7s.	....	....	1905		....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	216,000	1906	A. & O.	115¼	...
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Sept 12 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	90	......
Central Traction Co...............1st mtg. 5s.	375,000	375,000	1930	J. & J	......	...
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	117½
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108½	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	....
Fed'l St. & Pleasant Valley........Cons. 5s	1,250,000	1,250,000	1942	J. & J.	......	......
Millvale, Etna & Sharpsburg.............5s.	750,000	750,000	1923	M. & N.	105⅛	....
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1921	J. & J.	......	......
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	105¼	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co...................5s	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	...

Providence R. I.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	108	109

St. Louis.

Date of Quotation—Sept 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR.........1st mtg. 5s.	250,000	250,000	1918	J. & J.	100⅛	101⅛
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	101½	102½
Citizens' Railway Co............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,099,000	1918	J. & J.	111	112⅛

*With interest. *Unlisted. *With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Sept 21, 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	$50,000	$50,000	1906	J. & J.	80	85
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co..........1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	106½	107½
Missouri RR. Co..........	1,000,000	700,000	1916	M. & S.	107	108
†Mound City RR. Co..........1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	103
People's RR. Co..........1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‡People's RR. Co..........2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co..........Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co..........1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
‖St. Louis & Sub. Ry..........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry..........Income 5s.	800,000	800,000	......	......	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
‖Taylor Avenue St. Ry..........1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110½	111½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co..........Cons. mtg. 6s.	3,500,000	1,767,000	1918	J. & J.	115	116
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
§Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
‡$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Sept, 1898.						
California St. Cable RR....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	113½	115
†Ferries & Cliff House Ry....1st mtg. 6s.	650,000	650,000	1914	M. & S.	115½	....
Geary St., Park & Ocean RR.1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	93	100
Market St. Cable Ry. Co....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	126½	....
†Metropolitan Ry. Co..........1st mtg.	200,000	....	......	......	......	......
†Omnibus Cable Co..........1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127¼	128
†Park & Cliff House RR..........1st mtg. 6s.	850,000	850,000	1912	J. & J.	104½	105½
†Park & Ocean RR..........1st mtg. 6s.	250,000	250,000	1914	J. & J.	107	......
†Powell St. Ry..........1st mtg. 6s.	700,000	700,000	1912	M. & S.	118	120
Sutter St. Ry. Co..........1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Sept 12, 1898.						
Belt Ry. Co..........Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	......
Columbia Ry..........mtg. 6s.	500,000	500,000	1914	A. & O.	120	125
Eckington & Soldiers' Home..mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	121¾	......
††$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Sept 12, 1898.						
Bridgeport Traction Co..........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co....Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	118	115
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,866,000	1932	M. & N.	110½	111½
‖Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	101½	102
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	108¾	109
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	103
Denver City Cable Ry..........1st mtg. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	86
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	115	115¾
‖Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	91	92
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	3,000,000	2,878,000	1928	J. & J.	103	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)..........Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry..........1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	98	100
St. Paul City Ry..........Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry..........Deb. g. 5s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
§$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
‖$87,000 in treasury.						
‡$950,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Sept 12, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	106¼	....
Pittsburg, Pa.						
Date of Quotation—Sept 12, 1898						
Allegheny County Light Co..........6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light..........4s.	260,000	......	1913	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	......	......
Miscellaneous.—(Sept 12, 1898.)						
Edison El. Ilg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	110	..
Edison El. Ilg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117½	....
Edison Elec. Ilg. Co. (Brooklyn)..........	2,500,000	1,500,000	1940	......	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	......	......	....	......
Edison Illg. Co. (St. Louis)..........	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	......	1909	A. & O.	....	......
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	......	1921	Q'ry.	....	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	......

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Sept 12, 1898.						
American Bell Telephone..........7s.			1898	F. & A.	101½	....
Northwestern Telegraph Co..........7s.	....	......	....	......	......	....
N.Y. & N.J. Telep & Tel. Co. gen.mtg.5s	....	......	....	......	106	....
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Sept 12, 1898.						
American Electric Heating..........5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co..........	....	....	....	....	......	25
Barney & Smith Car Co..........†6s	....	....	1942	J. & J.	97	100
Carborundum Mfg. Co..........	....	....	1904	M. & S.	....	....
Worthington Pump Co	75,000	....	....	....	....	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12⅛c.; Lake, 12½c.; casting, 11⅞@12c.

The American Railway Electric Light Company announces an increase of capital stock from $2,500,000 to $3,000,000.

The United Traction & Electric Company of Jersey City has declared a dividend of ¾ per cent., payable October 1. Transfer books close September 21 and reopen October 4.

The annual report of the Metropolitan Street Railway Company, New York shows gross earnings of $9,938,503; net earnings, $4,638,069; surplus after charges, $1,845,570.

The Commercial Cable Company has declared its regular quarterly dividend of 1¾ per cent., payable October 1. Books close September 20 and will reopen October 3.

Application has been made to the New York Stock Exchange to list the reduced capital stock of the General Electric Company, $18,276,000 common stock and $2-551,200 preferred.

It is announced from Chicago as practically certain that the South Side "L" directors will be able to declare a lump dividend of 3 per cent. for 1898 if they are so disposed, the only question being if this year's earnings will not be put into extensions or new equipment, instead of being paid out to stockholders.

The Glens Falls, Sandy Hill & Fort Edward Street Railroad Company has filed its annual report with the New York Railroad Commissioners. The gross earnings for the year were $61,537; operating expenses, $44,556; other income, $2,882; fixed charges, $11,082; net income, $8,781; dividends, $7,225; surplus, $1,556; total surplus, $8,184.

President Coffin of the General Electric Company notified stockholders of the company by circular last week that the new certificates represented by the reduced number of shares would be ready for issuance on September 12, on which date transfer books would be opened. Convertible certificates will be issued for fractional amounts.

The stockholders of the American Telephone & Telegraph Company, at their special meeting on the 8th inst., voted to increase its capital stock from $20,000,000 to $25,000,000. A Boston financial paper states that the American Bell Telephone Company, which owns practically all the stock of the American Telephone & Telegraph Company, will take the additional stock the stockholders of the latter company have just authorized to be issued.

At the annual meeting of the United Electric Securities Company, Boston, held in Portland, Me., on the 8th inst., Philip Dexter and N. W. Rice were added to the board to succeed Arthur Perry and W. H. Whitney. A majority of the preferred stock was represented, the common stock being represented in full. The company invites proposals for sale to it of so many of its collateral trust 5 per cent. bonds of the fifth, eighth and ninth series as can be purchased with $59,421. Sealed proposals will be received until 12 M. September 21.

The Chicago "Record" of the 7th inst. says: "It is rumored that the Central Union Telegraph Company is about to resume dividends on its $6,605,300 capital stock. The company paid a dividend of 1 per cent. in 1896, but nothing in 1897. The affairs of the concern are said to be in a prosperous condition, and an increase in the earnings for the fiscal year is expected to the amount of about $500,000. The company operates the Bell Telephone Company's instruments in Indiana, Ohio and Illinois, except in Cook County. The earnings of last year were $1,436,898 gross. Operating expenses, which have been very heavy—about 81 per cent.—will be reduced."

The Louisville, Ky., "Courier-Journal" of the 8th inst. has the following: "Messrs. John C. Russell, St. John Boyle and George C. Norton will leave to-morrow for New York to attend a meeting to reorganize the New Orleans Traction Company. The gentlemen from Louisville will be met in New York by Mr. R. M. Walmsley, George Denegre, Albert Baldwin, C. H. Hymes and Mr. Howard of New Orleans, and a representative of Clark & Co. of Philadelphia. The meeting will be held September 15. The Louisville committee will have a plan of reorganization which will be submitted to the other gentlemen. There are some points of difference which the meeting is expected to decide."

A deed has been filed in the office of the Recorder of Deeds, Washington, D. C., which transfers the entire property of the Washington & Maryland Railway Company to the new City & Suburban Railway Company, formerly the Eckington & Soldiers' Home Railway Company. The consideration named is 10,000 shares of the capital stock of the City & Suburban Company of the par value of $500,000, and 200 of its first mortgage bonds, aggregating in all $700,000. In pursuance of the sale the Washington & Maryland Company delivers over all of its bonds for cancellation. The value of the real estate transferred is given as $240,000, and upon this amount the internal revenue tax was paid.

Henry A. Everett, of Cleveland, O., said in an interview a few days ago concerning the recent advance in Big Consolidated stock: "We have brought the stock up to where it belongs, that is all. The stock has not been quoted for what it is worth, and it is singular how ready the people are to sell when the stock is quoted at something like its real value." "Why has it been too low?" was asked. "There are several reasons. I will name one. Mr. Tom L. Johnson has been getting rid of a large quantity of the stock. He has unloaded something like 17,000 shares of it. Of course that would have a depressing effect on the market quotation."

A New York correspondent of the Boston "News Bureau" writes as follows: "We understand that the recent advance in General Electric has been brought about by a bull pool including several local operators. They thought conditions were right for a speculative turn intended to carry the price from 37 to the neighborhood of 50. The advance has not had support of insiders very fully. Insiders regard General Electric as worth only about the present price even if the company pays 6 per cent. on the new stock. It is quite possible that the price will go higher, but there will probably be a fair amount of realizing from this point up."

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CONTENTS.

EDITORIAL NOTES.

A New "Combine." The consolidation of the Westinghouse Electric & Manufacturing Company with the Walker Manufacturing Company was announced a few days ago. This new development in the electrical field may come as a surprise to some, but not so to us, as we have all along known that some such combination would sooner or later take place. The consolidation deal is said to have been under consideration for some time, but was only consummated on the 16th inst. Ostensibly the consolidation was the result of recent patent litigation, and was brought about, so it was claimed, principally with a view to reducing this item of expense, which is said to have consumed profits. It is unquestionably true that immense sums of money have been spent in litigation over trolley patents, and that recently, but we question whether this fact had any great weight in bringing about the present condition of affairs. In our opinion a number of wealthy financiers got interested in the Walker Manufacturing Company a short time ago without being fully acquainted with the exact condition of the electrical industry. As a result these gentlemen were obliged to accept the securities of the company which they had originally proposed to sell to the public. Every endeavor was then made by the new owners to secure as large an amount of business as possible, which they succeeded in doing, but unfortunately for those interested, the prevailing prices for electrical machinery were so low and there was so much competition that, in spite of the fact that the shops were full of work, little or no profit was being derived. A consolidation with the Westinghouse Company was apparently the easiest way out of the dilemma, and this appears to have been effected without any pecuniary consideration on either side, a block of the Westinghouse stock and bonds being exchanged for Walker securities upon a given ratio. By this arrangement competition in the line of street railway apparatus will be reduced as well as operating expenses. Again as of old, the employes will be the sufferers, as in all other consolidations.

* * *

Horseless Carriages. It would seem as though the Automobile Exposition recently held in Paris had caused many adherers of the mineral spirit motor driven carriage to somewhat change their views and acknowledge that for cleanliness, comfort and simplicity of operation the electrically propelled vehicle surpassed that driven by any other form of motive power. In the study of this problem of automobilism France is apparently far in the lead of any other country, as prizes have repeatedly been offered for road races and other suitable tests between vehicles propelled by electricity and various forms of steam and spirit motors. The late Exposition, as was to be expected, brought out a large array of almost every type of automobile. In one form of vehicle exhibited, the front wheels by which the carriage is propelled are separately connected each to its own motor. The latter are not securely fastened so as to remain at all times stationary but turn with the axle in steering. The motion is transmitted from the motors to the wheels by a simple arrangement of gears. It is claimed for this system that the vehicle may be turned in a very narrow space and that no complicated system of gearing is required to effect this. The storage batteries are, as is customary, located under the seats, the whole vehicle weighing about 2,500 lbs. Such an automobile can travel, so it is claimed, a distance of 44 miles without the batteries having to be recharged, at a speed varying between four and one-half and thirteen miles an hour.

In another form of automobile exhibited the motor is attached to the rear wheels, the armature having a double winding. With a view to reducing the weight to a minimum, the inventor of this system has had the motor casing and other such parts made of aluminum. The weight of the storage batteries for a five-seated phaeton of this description is 925 lbs. and for a two-seated vehicle 550 lbs. It is claimed that the batteries employed in this case will develop one horse-power for every 42 lbs. of weight, but whether this is so would seem problematical.

Although this country has by no means taken the interest in the horseless carriage problem that France has, there are at the present time in actual operation in New York City alone over one hundred automobiles. These are mostly in the form of hansoms and may be hired by the general public, having been built for this purpose by a company. These conveyances are propelled by means of a motor attached to the front wheels which can be made to exert a propelling force of from two to four horse-power. The requisite current is stored in 48 storage cells of 100 ampere hours' output. The storage batteries for each vehicle weigh about 1,250 lbs., each cell being incased in a rubber jar. The total weight of a hansom of this description, which is now fast becoming a common sight on the thoroughfares of this city, is 3,000 pounds. The feature of these hansoms which probably strikes the observer the most on first sight is the peculiar construction of the wheels. These instead of being built with wooden or metal spokes as in the case of the French automobiles are made of two metal plates ⅛ inch thick. This form of construction, although materially strengthening the wheels, and thus making them more durable, gives one the impression of weight and makes the carriage look clumsy. In fact, as may be seen from

the above figures, the hansom automobile as at present in use in this city weighs some 500 lbs. more than a French conveyance capable of carrying one or two more persons. In this case as in many others in this country, we have sacrificed beauty of design for strength. That the automobile, whether electrically propelled or otherwise, will never become popular in the United States, as it appears to be gaining in France, for country use and long distance runs, is an assured fact, for in traveling from one point to another the average American would prefer the more speedy and commodious means afforded by the railway. For city work, however, the electric automobile would seem to have advantages which should bring it more and more into practical use as the weight of storage batteries for a given output is reduced.

* * *

The Telephone Situation in London.

To the average American some of the facts brought out by the report recently issued by a special committee of the English Parliament on a method of improving the telephone service in London are surprising to say the least. That the largest and presumably one of the most enlightened cities in the world should be so tardy in adopting telephone facilities is astonishing. From all accounts many cities of one-tenth the population of the great English metropolis have as many or more call telephone offices and consequently better service.

A few years ago the telephone service in the United Kingdom was in the hands of the Government, as the telegraph service now is, both being run as a department of the Post Office; subsequently, however, it was thought advisable to grant a license to a private corporation, known as the National Telephone Company, to operate local exchanges, which license expires in 1911. The principal reason why the telephone has not become more popular in London would, however, seem to be, not the poor quality of service furnished, but the spirit of conservatism which prevails in England and to which may be attributed the fact that that country even now possesses but a few hundred miles of electrically propelled street railways. The following extract from the London correspondent of the New York *Sun* gives an excellent idea of this senseless conservatism :

"One of the principal banking houses of London installed a telephone in its chief office a few months ago. It proved a great nuisance. They were constantly called up about business matters which were usually dealt with by messenger. The clerk whose duty it was to answer the calls complained to the directors that his other work was much interfered with by the telephone bell. So the directors considerately ordered the removal of the offending instrument. Less than a week later the bank was mulcted in £1,200 by a clever swindler with a fraudulent check. Another banker had tried to send advance warning of the fraud by telephone, and the messenger whom he sent subsequently arrived too late. But even this lesson did not procure the reinstallation of the telephone. As a matter of fact, it is not considered quite respectable for a conservative banking house in London to include this new-fangled contrivance in its equipment."

As previously stated, the main object of the special committee of Parliament is to discover the defects of the present system with a view to its betterment. In the opinion of this committee the service as it now exists is inaccessible to those who only desire to use the telephone occasionally. To reap the full advantage it is necessary to pay a comparatively heavy subscription in return for a privilege quite limited in extent. The present system gives access to telephones only to subscribers, regarding which the special committee says :

"Just as if the Post Office should decide to despatch telegrams only from persons paying an annual subscription, and to allow such persons, on payment of their subscription, to despatch, without further charge, any number of telegrams, requiring at the same time that telegrams should be addressed only to persons connected with the Post Office telegraphs by private wires."

The Swiss plan is strongly advocated by the committee for the following reasons :

"Messages can be sent by non-subscribers from call offices and delivered to non-subscribers by express messengers, but, in addition to this, just as some persons in this country hire private telegraph wires to connect them with the general telegraph service, and thus avoid the necessity of delivering messages at or receiving them from a telegraph office, so persons who wish to save the journey to a call office to despatch a telephone message or to receive it direct instead of by a written message, can secure a private telephone in their house or office on payment of (after two years) £1 12s. For all messages actually sent subscribers and the public alike pay the same fixed toll, smaller if the message is a local one, larger if it travels over the trunk wire; the price for all distances over trunk wires in Switzerland being the same. Each message sent by a subscriber is numbered and an account against him is kept. It follows under this system that every telephone can be used by the general public instead of being confined to the actual subscriber, with the result that in many towns every shop or place of business which has a telephone becomes in practice a public call office."

One hundred dollars a year for so-called unlimited service in London does not at first sight seem exorbitant, but when it is recalled that probably one-half of the business transacted by telephone in this country has to be carried on by means of private messengers, on the other side, owing to the scarcity of telephone connections, the rate charged would seem ample.

Under the Searchlight.

Notes and Comments on Various Topics.

It is somewhat mortifying to have to acknowledge a delinquency, but when one is unfortunate it is just as well to be humble and confess. Owing to unavoidable circumstances and an unreliable reporter, we failed to give an account last week of an affair which was well worthy of prompt record. We refer to the electrical clam dinner given at the Pomham Club, Providence, by Mr. Eugene F. Phillips and the American Electrical Works. We had secured the services of an expert note-taker of high gastronomic intelligence and a keen appetite for everything choice in the fish line, so he claimed, and rested easy in the expectation of getting a report of the proceedings at that dinner that would insure the sale of at least a thousand extra copies of the paper and be read with avidity by every clam baker in the country and along shore. His report failed to reach us in time for last week's paper ,and when the man himself put in his tardy appearance he offered the apology that the clam dinner was such a fine affair and so prismatic in its multitudinous enjoyments that it would be damaging for any serious reporter's reputation to attempt a hasty description of it, so he had jotted down a few of the best-balanced occurrences and set out for the train that he expected to take for home. When he reached the depot he found that he had a couple of hours to wait, so he thought he would take a run round the State and see the landscape. The walk was longer than he had estimated, for there is a good deal of land in Little Rhody after all, and when he returned to the depot the train had departed. This rattled him, and, as was to be expected, having failed to accomplish what he was employed to do, he decided to let the world go by and put his trust in Providence. When we tackled him for his neglect, he bore our censures without even a blush, sustained apparently by the recollection that anyway he had enjoyed a royal feast of clams and the company of a big crowd of the brightest fellows in the electrical business, and had seen much of the territory that Roger Williams and Anne Hutchinson had chosen as an asylum from Puritan fanaticism.

The clam dinner, as is now well known, came off at the time set, on the 10th inst., and was voted superb by all who attended it, and these had gathered from all sections of the country not included in our new territories. At the next annual clambake of the American Electrical Works, we have no doubt that the veteran host, Mr. Eugene F. Phillips, will have the satisfaction of greeting several new faces, some perhaps of Mongolian contour, from the lands our conquering squadrons and armies have added to our possessions. We trust our reportorial arrangements at that time will be adequate to the occasion, and carried out without necessitating a gall-shriveling apology.

* * *

In order to meet the difficulties experienced with railway car brakes, the ingenious Kubierschky brake, says the *Scientific Press*, has been invented. It is composed of four steel segments and coils inclosing one of the car axles, the segments being bolted together and acting as a brakeshoe, thus forming a rigid system that is bolted, by means of a projecting shank, to an arm arranged in the under frame of the car. In front of the shoe is an iron disk, fixed and keyed to the car axle, which forms the armature to the shoe, this being held at its proper distance from the shoe by springs. On an electric current being passed through the coils, the friction surface of the brakeshoe is brought into contact with the disk, checking the rotation of the axle and the progress of the car. At Dresden, as reported, the application of the brake to a seven-ton car traveling at fifteen miles an hour brought the car to rest within a distance of forty feet.

* * *

A Use for Liquefied Air.

It is reported that a use has been found for liquefied air, the possibilities of which have been matters of discussion among scientific men for some time. According to the *Mining Reporter*, a discovery was made recently by which it is now practicable to use liquefied air in underground work, such as mining, driving tunnels and sinking shafts. It is said that under proper conditions the liberation of air from the liquid can be effective in generating power with which to run drills under ground, pumps, hoists, etc., while cool air can also be supplied in the deepest mines. The liquid air can also be used in freezing soft ground, making tunnel cutting less hazardous and tedious. If there is any reliability in this reported discovery, and its success can be practically demonstrated, it will make a new departure in the lines of work named, and once again make the genius of science the soul of industrial progress.

* * *

The *Electrical Engineer*, London, referring to the General Electric Company, says : "This large manufacturing and financing concern does an enormous business, but has not been able for years past to make money for its shareholders. Hence the conclusion arose that the business was over-capitalized, and by a special resolution the capital has been reduced from £6,092,000 to £4,165,400. There is no doubt that the company originally valued its patent rights too highly, and that the smaller sum more nearly represents the value of the undertaking. Even at this value no figures are published to show that dividends can be paid, but the officers of the company say that this is the case. It is a pity that such large ventures should not be run, at least to some extent, in the interests of those who have found the money to start them."

CANADIAN NOTES.

Mr. J. W. Poupore, M.P. for Pontiac, is negotiating with an American syndicate capitalized at $5,000,000 to erect smelters at Ottawa and Georgian Bay in connection with the Ottawa ship canal. In relation to this, a gentleman is in Ottawa to patent an electrical smelter.

Complaints have been made to the Agricultural Department of Canada by Montreal shippers respecting damage occasioned to perishable articles of export, owing to lack of proper ventilation on some of the steamships. It is understood that at least fifteen of the principal ocean-going steamers sailing out of that port will be fitted this fall with electric apparatus for proper ventilation.

The city council of Toronto, Ont., has accepted the tender of the Sprague Elevator Company of New York for the supply of three electric elevators, with the plant for five, for the new municipal buildings of Toronto. The architect states that the electric plant will operate 300 or 400 lights in addition to the power required for running the elevators.

A company of capitalists in Winnipeg, Manitoba, purposes utilizing a portion of the water power on the Winnipeg river. The scheme involves the establishment of an electric railway from the mouth of the Whitemouth river to points along the Winnipeg river, and also the transmission of electric power to the city of Winnipeg.

The Shawinigan Water & Power Company, which proposes to utilize Shawinigan Falls on the St. Maurice River, in the province of Quebec, seventeen miles from the town of Three Rivers, has decided to install at once a plant capable of developing 100,000 horse-power. The plans have been prepared by T. Pringle & Son of Montreal, assisted as consulting engineer by W. C. Johnson of Niagara Falls, N. Y., and the company is now calling for tenders. It is understood that power will be sold at Three Rivers cheaper than it can be obtained at any other port in the world reached by ocean-going vessels, and also at the falls at a proportionately low figure. A strong company has been formed, with the following directorate: A. F. Gault, Thos. McDougall, Hon. L. J. Forget, P. N. Greenshields, all of Montreal, and John Joyce, H. H. Melville and J. E. Aldred of Boston, Mass. The company is confident that the advantages which it can offer to manufacturers on a large scale are so great that it will mark an era in the industrial development of the province of Quebec.

The Cataract Power Company of Hamilton, Ont., formed its first connection with that city last week, sending in 22,000 volts over the wires from its water-power canal near Thorold, Ont., thus demonstrating its ability to convey electrical power a distance of 40 miles. The plant to do this cost about $500,000. A large driving motor of 40 horse power was used in the test, and 200 incandescent lamps had been arranged in the form of a shield which were illuminated. It is expected the company will supply the Hamilton Electric Light and Power Company with power for its dynamos by October 1.

The Edison Illuminating Companies' Meeting.

The nineteenth annual meeting of the Association of Edison Illuminating Companies was held at Sault Ste. Marie, Mich., on the 12th, 13th and 14th inst. About eighty delegates were present. Papers on various subjects connected with electric lighting and management were read. Among the authors of these were W. S. Barstow of the Brooklyn Edison Company, K. W. Liele of the New York Edison Company, A. E. Leslie and Charles S. Shepard of New York; Oliver Bushnell, Chicago; Caryl D. Haskins, Boston; C. E. Perry, Indianapolis, and W. E. Kingan, Sault Ste. Marie.

A large number of ladies accompanied the delegates, and steamboat excursions and social entertainments made the visitors feel that they were abundantly repaid for their trip to the "Soo."

THE BRITISH ASSOCIATION.

(From our London Correspondent.)

The Bristol meeting of the British Association opened on Wednesday, September 7, with the address of the president, Sir William Crookes. The number of members and associates who had registered their names at Bristol up to Wednesday evening was 2,284, including a number of eminent scientists from foreign countries, some of whom were expressly in attendance for the purpose of taking part in the important conference on "Terrestrial Magnetism and Atmospheric Electricity" which is being presided over by Prof. Rucker. References congratulatory in character were made to the conference in several of the sectional addresses. Prof. W. E. Ayrton, F. R. S., in his address to the Mathematical Section expressed himself as follows:

"The earth is an object of much importance to the terrestrial magnetician, the telegraph electrician and the tramway engineer, but while the first aims at observing its magnetism and the second rejoices in the absence of earth currents which interfere with the sending of messages, the third seems bent on converting our maps of lines of force into maps of lines of tramway. It seems as if electric traction is destined in time to annihilate magnetic observatories near towns, and even to interfere with telegraph and telephone systems. The principle of the survival of the fittest is quoted by some electrical engineers, but can the system of electric traction, which has already destroyed the two most important magnetic observatories in the United States and British North America, be the fittest to survive? Again, do we take such care and spend such sums in tending the weak and nursing the sick because we are convinced that they are the fittest to survive? Let the electrical engineer who is inclined to think slightingly of the deflection of a little magnet compared with the whirl of his 1,000 HP. dynamo go and visit a certain dark storeroom near the entrance hall of the Royal Institution, and while he looks at some little coils there ponder on the blaze of light shed over the whole world from the dimly lighted cupboard in which those dusty coils now lie. Then he may realize that while the earth as a magnet has endured for all time, the earth as a tramway conductor may at no distant date be relegated to the class of temporary makeshifts.

"During the present year the publication of abstracts of foreign papers on physics, begun by the Physical Society in 1895, has been continued jointly with the Institution of Electrical Engineers. *Science Abstracts* was the name selected for this periodical, and its contents include general physics with separate sections for each branch, and general electric engineering with separate sections for each of its more important sub-divisions. Its value is already recognized by the British Association and by the Institution of Civil Engineers, who make liberal contributions towards the expenses of publication. It is hoped that finally the scheme may be supported by the scientific societies of many Anglo-Saxon countries, as the saving of time and trouble that will be effected by such a journal can hardly be overestimated."

The International Conference was opened on the morning of the 8th inst. by an address delivered by the president, Prof. Rucker, in which he referred to the danger, alluded to by Prof. Ayrton, of the rapid extension of electrical railways affecting magnetic observatories and thus interfering with researches of ultimate benefit to the whole human race.

A paper was read by Professors E. B. Rosa and W. O. Attwater on "Conservation of Energy in the Human Body." A discussion followed and Prof. Aryton drew attention to the fact that the energy of muscular action is probably capillary or electrical, the human machine being more analagous to an electric battery and motor than to a steam engine. Mr. W. N. Shaw agreed with Prof. Ayrton's view of the electro-chemical nature of the energy of the human body.

A report submitted by the "Committee on Comparing and Reducing Magnetic Observations" was taken as read.

COST OF ELECTRIC POWER FOR STREET RAILWAYS AT THE SWITCHBOARD STEAM AND WATER POWER.*

BY R. W. CONANT.

It is my privilege to be able to communicate to you facts and figures bearing on the operation of forty-four power stations located at the important street railway centers throughout the country. These figures cover for the most part the operation of the stations during the past year, and were obtained through the kindness of members of this Association, as well as from experience on the roads in Boston. The aggregate capacity of power stations represented is 98,387 KW., or 131,800 electrical HP.

The total cost of operation for the production of power alone from these stations during the past year has been $1,825,000, and *if* the power had been produced by all at as low a cost as it was in a number of the more economical stations the saving for the year would have amounted to $443,300. It is the chief purpose of this paper to explain the *if*, and to obtain some idea of its size.

In what has been published on this subject there are a great variety of opinions as to what should be included in the cost of power, and also as to whether the basis of comparison should be the car-mile or KW. hour, this latter being due to the fact that up to within a few years there had been no reliable instrument adopted by street railways for the measuring of their output.

The car-mile basis is not a fixed standard. A car-mile up hill takes a great deal of power, while a car-mile down hill should take none, and may be made a source of power.

In the analysis of costs of operation of power stations of various sizes and types it is first necessary to adopt a standard for the unit of power. We have seen that the car-mile is unreliable. Recording wattmeters are at present constructed which will measure the output in KW. hours. They can be made to give results which are accurate within a very few per cent. This statement is abundantly verified by actual experience, and is gradually becoming universally recognized. It is no doubt difficult for one who has been accustomed to figure cost of power production on a car-mile basis to reconcile himself to the KW. hour. It should, however, be very easy for the steam engineer who is accustomed to deal with HP., since the KW. hour equals 1.34 electrical HP. hours.

It was evidently the idea of your Executive Committee in limiting the title of this paper to cost at the switchboard to abolish the car mile and adopt the KW. hour as the unit of power. And in comparing the costs from the various stations I shall use this unit. For the benefit of those who are accustomed to considering the costs per car mile it will be interesting to know that on many roads a car mile takes just about 1 KW. hour. This is not true where grades and equipments are extremely heavy; in such cases two or three times this amount may be required.

In the costs of power, whether it is produced by steam or water, should be included the fixed charges as well as the cost of operation. Under fixed charges are interest, depreciation, insurance and taxes on the capital invested in the land, buildings and machinery of the power station. Under operating expenses are fuel, labor, supplies, repairs, superintendence and general expense. In both the fixed charges and operating expenses the component items vary between widely different limits, and it becomes impossible to construct a law that will predict the cost under all circumstances. On the other hand, for one who has had experience it is comparatively easy to predict what the power ought to cost under a given set of conditions. What it will cost must, of course, depend on management as well. In view of the

* Paper read at the Convention of the American Street Railway Association, Boston, Sept. 6-9, 1898.

variety of the circumstances governing these costs, I have deemed it advisable to establish for purposes of comparison a standard plant whose conditions are fixed.

It is not my intention to imply that the performance or equipment of this station which I shall employ as a standard is ideal or could not be bettered, but rather to assume equipment and performance based on facts obtained from stations in actual commercial operation during a long period of time. As this station is described, its performance may seem to border on the ideal, and there is no question but that its performance is consequent on favorable circumstances—very nearly, we may say, test conditions. It is, however, in my opinion, best to err on this side rather than on the other in establishing a station for comparison.

I shall assume the station to be located on the water front; the exact spot is unimportant, but since this Association has chosen Boston as its meeting place we can consistently locate the station here as well. I have fixed the capacity at 3,600 KW.; the building erected on firm ground requiring but little piling or filling, building and chimney of brick.

For equipment, three cross compound condensing engines, cylinders 28 in. and 56 in. by 5 ft. stroke, speed 80 revolutions per minute, steam pressure 150 lbs.; three 1,200-KW. direct-connected generators, six water-tube safety boilers, 500 HP. each, economizers and exhaust feed water heaters, electrically driven feed pumps and coal handling apparatus. Such a station would cost to install as follows:

CAPITAL INVESTED.

Building, foundations for engines and boilers, chimney, coal handling apparatus	$120,000
Engines and condensers, heaters, separators and piping	91,800
Feed pumps and economizers	18,000
Boilers and flue connections complete	61,000
Generators and switchboard complete	73,800
Land and docking facilities	17,000
Engineering and sundries	5,000
Total	$386,600

or about $107 per KW. capacity.

To obtain the figure for fixed charges I assume interest at 6 per cent., insurance and taxes 3 per cent., depreciation 2 per cent., total 11 per cent., which makes an annual fixed charge of $42,526.

I shall assume that this station produces 10,500,000 KW. hours per annum; dividing the annual charge by this figure gives four cents per KW. hour for fixed charges. The depreciation is not intended to cover repairs, which will be included under operating expenses. The 2 per cent. assumed for depreciation is to establish a sinking fund against the time when the station will have to be entirely replaced by one of more modern and economical design, time of replacement being taken at fifty years. A few years ago the time of replacement should have been assumed much shorter, owing to the imperfect design of power station apparatus then existing. But with the present advanced state of the art improvements cannot be expected to develop as rapidly.

Before arriving at the cost to produce power from this station it will be necessary to obtain the operating expenses. In making comparisons between stations of different sizes and types the cost of labor is the most perplexing item, some stations operating with two shifts, others three. Some have engineers paid at different rates, and men which appear on the records of some are in a capacity which in others is absent or replaced by men of another class and rate of pay. I therefore give the following method of analysis of the labor item, which gives satisfactory results when applied to station operation.

I can illustrate the method and at the same time derive the operating expenses by applying it to our standard station. It is assumed that this station operates with three shifts of men, the duration of each shift being eight hours. This makes the shift-hours per day 24, or 8,760 for the year. The same number of shift-hours would of course be obtained by two shifts of 12 hours each, as is the case with some stations. For the three-shift station, the first two probably would have the full complement of men, while the third would not, as the station might be shut down on that shift. But as there is considerable inspection, cleaning and overhauling, this shift requires almost as many men, though their rate of pay may be less. The highest rates of pay would be on the shift of heaviest load. The crew to operate the standard plant would be about as follows: Two engineers, one oiler, one helper, two firemen, one coal passer; total, seven men per shift.

The average rate of pay per man is taken at 27 cents per hour. This would be calculated from an actual station by dividing the total amount paid for wages, including chief engineer's salary, by the product of the number of men operating with the hours each has worked. The number of men per shift for this station being 7, I will divide this figure by 3.6, which is the figure expressing the capacity in 1,000 KW. units. This division gives 1.94 as the number of men per shift per 1,000 KW. capacity. This figure will vary with the type and size of station, as we shall see later. The fractional part of the man of course only appears in figuring.

Multiplying the 1.94 by the rate of pay, 27 cents, gives 52 cents as the cost of labor per hour per 1,000 KW. capacity. This multiplied by 3.6, the number of 1,000 KW. capacity, gives $1.87 as the total cost of labor required to operate the station per hour.

It will further aid in the analysis of the labor item to introduce the load factor. As this term is sometimes employed in a different sense from that used in this paper, I shall define it to be that per cent. which when multiplied by the capacity of the station in KW. and by the shift hours for the period gives the KW. hours' output for the time considered. I take as the load factor of this station 33 per cent. average for the year. You may remember that in the consideration of the fixed charges I gave as the KW. hours per year 10,500,000, which is 33.3 per cent. of 3,600 KW. multiplied by 8,760, the shift hours per annum.

It has been shown above that $1.87 is the average cost of labor to operate the station for one hour, and if we obtain the average KW. during the hour, which is KW. hours for that period, a simple division will give the figure for the cost of labor per KW. hour. The load factor gives the means of obtaining the KW. hours, and by multiplying 3.6 by 1,000 and 33.3 per cent. gives 12,000 as the average KW. for the hour or KW. hours for that period. Dividing $1.87, cost of labor to operate the station per hour, by 1,200 gives .157 cent as the cost of labor per KW. hour.

But 3.6, the figure representing the capacity, was used as a multiplier in obtaining both the cost of labor, $1.87, and 1,200 KW. hours. It therefore disappears in the division, and the expression for t cost of labor per KW. hour is made independent of the capacity of the station to that extent. The rule

TABLE No. 2.—DATA ON "OPERATION OF POWER STATIONS."

No. of Station	Cap. in 1,000 k. w.	Type: Units E	Type: Units G	Type: B. or D.C.	Type: S.C.T.	Type: N. or C.	Period—Days	Load Factor—Per Cent	Taken from Car-miles	Labor: Shifts	Labor: Duration	Labor: Shift-hours	Labor: Men per 1,000 k. w.	Labor: Rate of Pay	Labor: Cts. per k. w. Hr.	Fuel: Lbs. per k. w. Hr.	Fuel: Price ($) per Ton	Fuel: Kind—A. or B.	Fuel: Cts. per k. w. Hr.	Gen. Ex.—Per k. w. Hr.	Total Op.—Per k. w. Hr.	Fixed Charges
9	3.6	3	3	D.C.	C.	C.	365	33⅓	...	3	8	8,760	1.94	27	.157	2.2	3	B.	.33	.093	.58	.405
10	.4	2	2	D.C.	S.	N.	1	24	...	...	...	...	7.5	18	...	...	2	.5 A. .5 B.	...	...	1.5	...
11	1.4	5	8	B.	S.	N.	365	33	×	2	12	8,760	3.7	20	.32	6.7	2.24	A.	.75	.33	1.4	...
12	1.0	3	7	B.	C.	C.	365	23	...	2	12	8,760	3.7	20	.31	4.8	2.63	B.	.63	.11	1.05	.44
13	2.0	4	4	D.C.	S.	N.	365	42	...	2	12	8,760	8.0	22	.16	6.5	1.44	B.	.47	.09	.72	.24
14	1.6	4	4	B. D.C.	S.C.	N.C.	365	19	...	2	12	8,760	1.67	15	...	...	...	...	...	...	...	...
15	1.6	10	16	B.	S.C.	N.C.	183	41	...	2	12	4,380	6.3	16	.25	6.5	2.10	B.	.68	.14	1.07	.24
16	1.6	8	8	B.	C.	C.	365	33	...	3	8	8,760	3.7	20	.23	5	3.30	B.	.83	.09	1.15	...
17	.8	2	4	B.	C.	C.	365	24	×	2	12	8,760	8.7	18	.28	5	1.43	B.	.36	.06	.70	...
18	.4	2	3	B.	S.	N.	365	...	...	2	12	8,760	3.7	12	...	...	.75	B.	...	...	...	...
19	3.0	6	6	D.C.	...	...	...	81	...	2	12	744	8.0	17	...	...	.60	...	...	...	.68	...
23	.6	3	3	B.	C.	C.	183	16	×	2	12	4,380	3.3	25	.51	6	3.41	B.	1.03	.16	1.7	1.
25	4.0	10	10	B.	S.	N.	365	33	...	2	12	8,760	...	...	...	5.6	1.05	...	.29	...	.56	...
26	.8	7	12	B.	S.	N.	365	19	...	2	12	8,760	...	...	...	6.8	1.15	...	.39	...	1.2	...
28	1.4	4	8	B.	S.	C.	81	23	...	2	12	744	5.0	17	.37	7	1.63	...	.57	.08	1.02	...
29	1.9	5	5	B.	C.	C.	365	27	...	2	10	7,300	3.2	21	.25	3.9	2.80	...	.55	.23	1.03	...
30	1.7	5	5	B.	C.	C.	365	23	...	2	10	7,300	3.0	21	.27	3.3	3	B.	.49	.15	.91	...
31	.9	3	3	B.	C.	C.	365	32	...	2	10	7,300	4.5	21	.29	4.4	2.84	B.	.62	.19	1.1	...
32	5.8	5	30	B.	C.	C.	365	31	...	2	12	8,760	3.5	20	.23	3.5	3	B.	.52	.09	.84	...
33	1.5	4	12	B. D.C.	C.	C.	365	10	...	2	12	8,760	5.0	20	.62	4.3	3.08	B.	.66	.22	1.5	...
34	2.0	4	4	D.C.	C.	C.	183	57	...	2	12	4,392	5.0	20	.18	5.3	1.0	B.	.27	.12	.57	...
35	1.2	1	1	D.C.	C.	C.	365	37	...	2	12	8,760	2.1	20	.15	4.7	1.24	B.	.29	.04	.48	...
37	1.5	8	11	B.	C.S.	C.N.	151	11	...	2	12	3,624	8.0	16	1.1	7.8	1.75	.5 A. .5 B.	.63	.12	1.85	...
40	9.2	6	6	D.C.	C.	C.	365	36	...	3	8	8,760	2.7	23	.17	3	1.60	A.	.24	.11	.52	...
42	1.8	8	6	B.	C.	N.	365	45	...	3	8	8,760	5.0	26	.29	5.7	1.60	A.	.45	.18	.92	...
43	3.3	5	10	B. D.C.	C.	C.	365	15	...	2	12	8,760	8.7	16	.39	3.7	2.70	.6 B. .4 A.	.50	.14	1.03	...
44	6.0	6	12	B.	C.	C.	365	30	...	3	8	8,760	3.3	24	.26	3.5	1.60	A.	.28	.15	.69	...
45	1.0	4	7	B. D.C.	C.	C.	30	28	×	2	10	600	3.0	15	.16	4.7	1.90	B.	.45	.05	.66	...
47	.75	4	4	D.C.	C.	C.	183	20	×	2	12	4,380	8.0	12	.41	5.1	2.12	.5 A. .5 B.	.54	.21	1.16	...
48	.6	2	2	D.C.	C.	C.	365	35	...	2	10	7,300	6.7	15	.29	3.3	2.75	B.	.45	.28	1.02	...
50	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

then for obtaining the cost of labor per KW. hour for any station is to multiply the rate of pay of the men by the number of men per 1,000 KW. capacity and divide by the product of the load factor and 1,000.

The use of this method will be illustrated if we compare the cost of labor per KW. hour in the first two columns of Table No. 1. It is .157 for the standard and 56 cents for station No. 1. It is rather difficult to account for this great increase until we notice that the men per 1,000 KW. is 4.7 as against 1.94. The rate of pay and load factor also enter, as I shall show later.

I have constructed a diagram which gives the results of this expression for cost of labor for all usual rates of pay, load factors and men per 1,000 KW. This diagram is based on a rate of 27 cents per hour, and there is also given a reduction table, which gives the per cent. to be added or subtracted for other rates than this. To illustrate its use, suppose we have a station whose equipment requires five men per shift per 1,000 KW. capacity. During a month of high output it might operate at a 30 per cent. load factor. On the diagram, following 5 up to 30 gives cost of labor at 45 cents per KW. hour. In a lighter month the station might operate at a 15 per cent. load factor. Following 5 up to 15 gives 9 cents, or twice as much for labor per KW. hour.

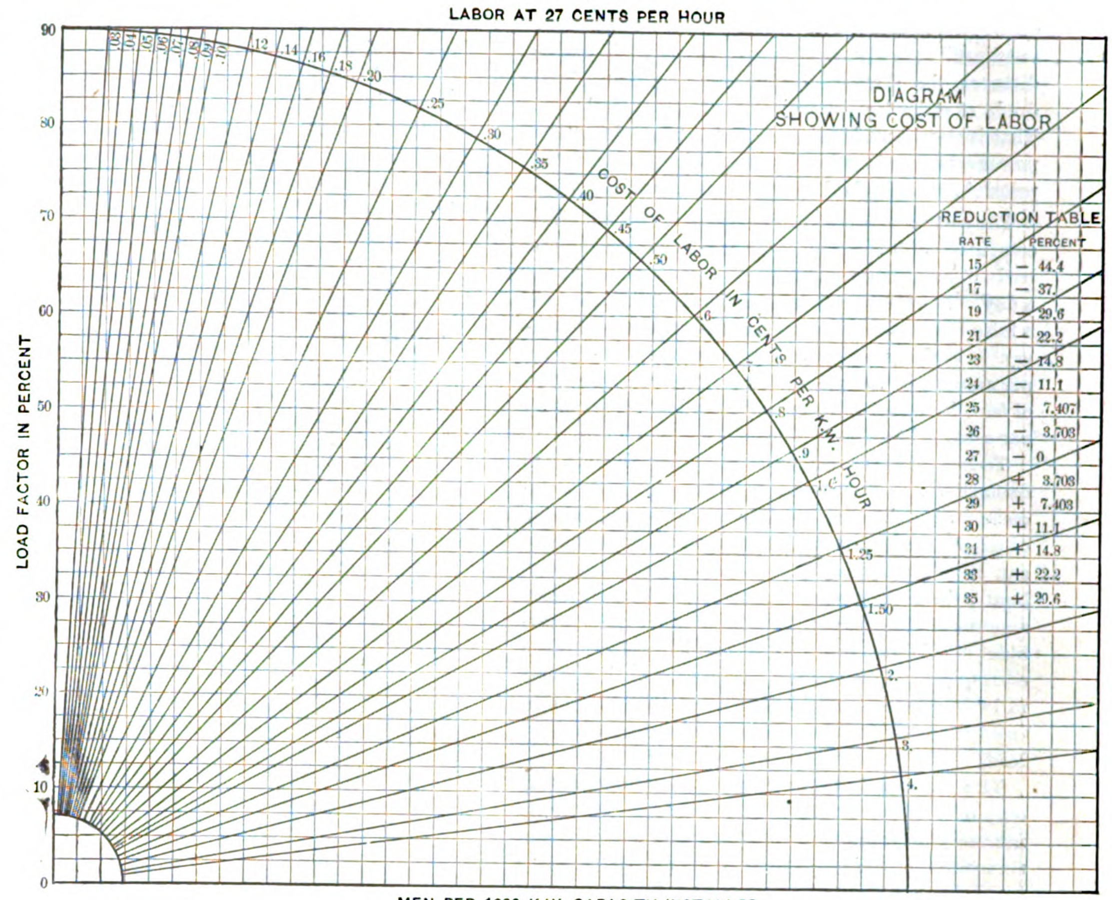
To further illustrate the use of this diagram, let us consider that the equipment of our standard station is cut into so many units that it required 3.7 men instead of 1.94. Price of labor and load factor being 27 cents and 33.3 per cent. respectively, 3.7 followed on the diagram up to 33.3 per cent. gives .3 of a cent, as against .157 cent for standard.

The cost of fuel is the next item to be considered in the operating expenses of the standard station. Considering coal as the fuel used, its cost per KW. hour depends on the price per ton and on the efficiency of the station, which is best expressed in pounds coal consumption per KW. hour. The coal for standard station I have assumed to be clear bituminous, costing $3 per short ton delivered.

As to the efficiency, I am able to quote from tests in which I was personally engaged on a station of the same size and similar equipment. The duration of the test was forty-five hours, made under actual conditions of railroad service during the day, and at night the load was kept on the station by means of a water rheostat. I will say here, however, that the test on the steady night load did not show any great gain in efficiency, due to the fact that the day load of the station was steadied by feeding in with others. The average efficiency of transformation IHP. to EHP. at the switchboard was 90 per cent. The steam consumption of the engines was 14.5 lbs. per IHP. hour. This record on a later test has been lowered. The boiler evaporation was 9.4 lbs. water per lb. of coal from actual conditions. The coal used was New River bituminous. The economy of the station, represented by the coal consumption in pounds per KW. hour, was 2.3. I have assumed 2.2 for this figure for the standard station.

Reducing price per ton to price per pound and multiplying by 2.2 gives .33 cent as the cost of coal per KW. hour. This appears in Table No. 1 under cost of fuel. As an illustration of what the cost would have been had the engines required more steam, say 26.6 lbs. per IHP. hour, as might be the case with a non-condensing engine, referring to the fuel diagram and considering the electrical efficiency, boiler evaporation and price of coal to remain the same, 26.6 to 9.4 lbs. water per pound of coal gives 3.8 lbs. coal per KW. hour. Following this line down to horizontal $3 coal line and vertically upward from this point to cost of fuel in cents per KW. hour we obtain .57 cent, were the efficiency of transformation 100 per cent., but since it is assumed to be but 90 per cent., 11 per cent. has to be added to this cost, as shown in the reduction table. This gives the cost of coal per KW. hour .63 cent, as against .33 for the condensing engine.

There remains to be included in the operating expenses for this station, water, oil, small supplies, repairs, superintendence and general expense, which I



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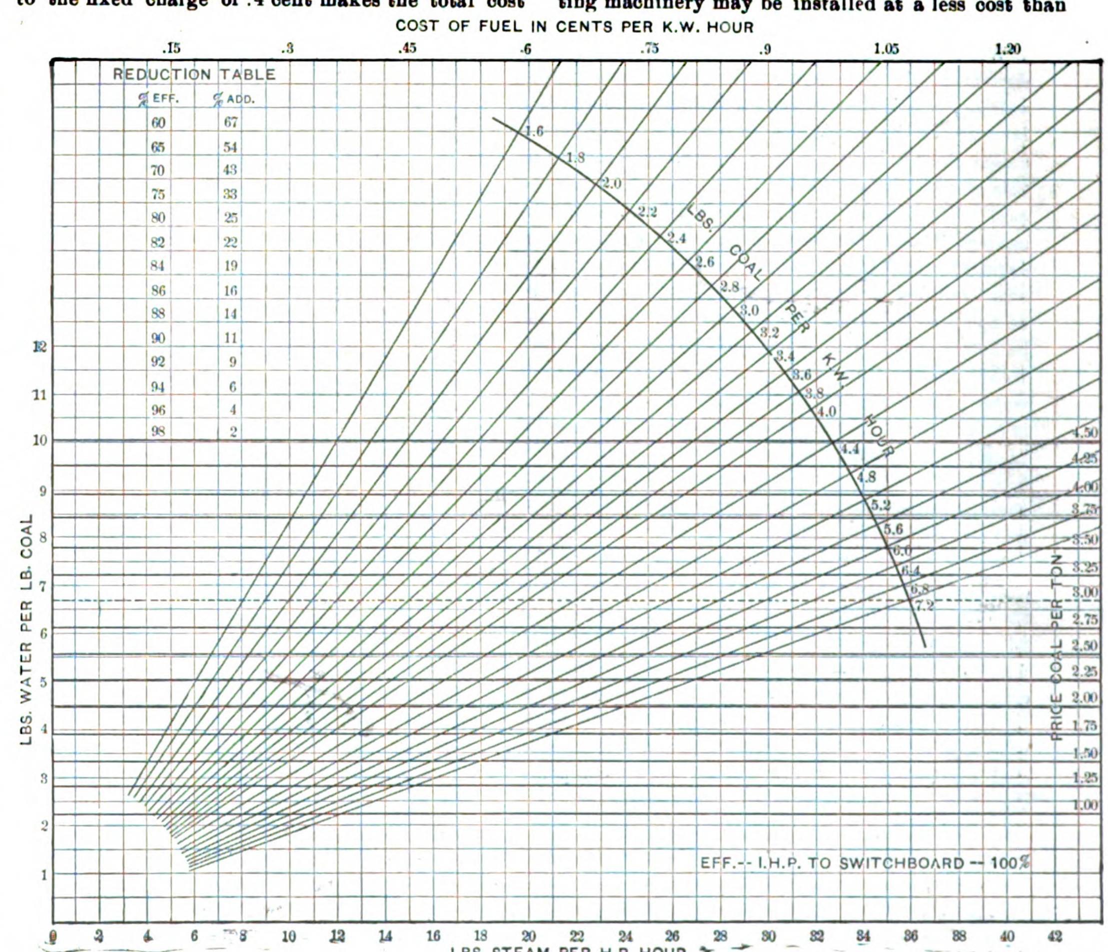
have estimated at .093 cent per KW. hour. The total operating expense foots up to .58 cent., which added to the fixed charge of .4 cent makes the total cost



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power from standard .98 cent or very nearly one cent per KW. hour.

Before comparing the costs from the various steam plants I will review briefly the circumstances governing the production of power by water.

The application of water power to street railways has the following points of advantage: In plants operated under any but very low heads the generating machinery may be installed at a less cost than for steam. The fuel expense also disappears as well as a portion of the cost of repairs. A part of the labor expense will be saved, inasmuch as

no engineers, firemen or coal handlers are required The main disadvantage in the application of water power to street railway operation lies in the fact that generally railroad power stations are quite distant from waterfalls, and that it is very expensive to transmit the electrical energy to any considerable distance, the distance of transmission being hundreds of miles for the majority of street railways. That it may be made more profitable to employ water power when its location is nearby the road and the price of coal is high also, there can be no doubt.

The cost to produce power from water is often compared with the cost to produce from coal on the basis of continuous operation for twenty-four hours a day. For street railway service this method gives a false impression, since it implies that the machinery is working at its full capacity for 8,760 hours per annum, or 100 per cent. load factor; as a matter of fact, for street railway service a load factor of 33 per cent. is high.

To look at this from another point of view, the demand for power for street railways cannot be increased at will, as it may be in a manufacturing concern. In the latter, if it is found advisable to run night and day at full capacity, instead of ten hours, there is produced a correspondingly greater amount of the product, be it flour, steel rails or carbide of calcium, and this output is produced at a correspondingly decreased cost per unit. For street railway service, on the other hand, there has to be installed sufficient machinery to take the peak of the load.

This is usually three times the average, and is only of a few hours' duration each day. If it were necessary or profitable to use this full capacity continuously for other industries it would be possible to do this with very little increase of labor, no increase of fixed charges, and the additional expense of producing the greater output would be merely the coal and a slight increase of supplies and repairs. This combination is the feature of the Niagara work.

When the expense of transmission shall have been decreased by the successful employment of higher voltage, it will then become a problem as to whether it will not be profitable to produce power from a steam plant located at a coal mine, coal costing in this case but 80 cents a ton. This would bring the cost of fuel down to .12 cent per KW. hour, as against .33 cent for standard plant. Further, this expense would only continue for the comparatively small number of hours that the plant would have to be operated for street railway service. This might be better economy than to pay the fixed charges that would accrue from the expensive development of water powers at possibly much greater distances. It is to be noticed in this connection that the cost of installing the steam station would be considerably less when located at the coal mine, since it would then be unnecessary to equip with the most economical and expensive machines.

Water power produced in various parts of the country varies greatly in its cost. It is reported that the electrical energy so produced costs from $14 to $32 per annum per KW. continuous output. This expense is largely made up of fixed charges, which increase rapidly as the expense of making the necessary improvements is greater. The standard steam plant produces power with $3 coal for $29, and with 80 cent coal for $22 per KW. per annum, which compares very favorably with the above for water power.

A disadvantage occurring in the use of water power is that in some cases, on account of certain periods of low water, an auxiliary steam plant has to be kept in reserve, which is, of course, an additional expense. There can be no general rule given that will determine whether it is more advantageous to use water or steam power. Each case must be figured by a competent engineer and decided on its merits.

The great majority of street railways being operated by steam, I shall not dwell longer on water power, as there is considerable ground to be covered in the consideration of the steam stations. I have compiled and classified the data on representative ones throughout the country; Tables No. 1 and No. 2 give the results.

The general arrangement of the tables is as follows: Each vertical column contains the data for a different station during a stated period. Each station is represented by a number, which appears at the head of the column; only a portion of the table is exhibited to you on the large diagram, for obvious reasons, but I will describe the different items as they appear in the completed table. The first column is headed

TABLE No. 1.—SHOWING COST OF OPERATION OF POWER STATIONS.

	No. of Station.	S.	1	2	3	4	5	6	S.	1	2	3	4	5	6	S.	1	2	3	4	5	6
	Cap. in 1,000 k. w	3.6	.6	2	1.6	12.68	2.38	.744	3.6	.6	2	1.6	12.68	2.38	.744	3.6	.6	2	1.6	12.68	2.38	.744
Type.	Units E	3	3	2	2	8	2	4	3	3	2	2	8	2	4	3	3	2	2	8	2	4
	Units G	3	3	2	2	8	7	12	3	3	2	2	8	7	12	3	3	2	2	8	7	12
	Units E per 1000 k. w	.83	5	1	1.25	.63	.84	5.4	.83	5	1	1.25	.63	.84	5 4	.83	5	1	1 25	.63	.84	5 4
	Units G per 1000 k. w	.83	5	1	1.25	.63	2.94	16.2	.83	5	1	1.25	.63	2.94	16.2	.83	5	1	1.25	.63	2.94	16.2
	B. D. C	D. C.	D.C.	D.C.	D.C.	D.C.	B.	B.	D.C.	D.C.	D.C.	D C.	D.C	B.	B.	D.C.	D.C.	D C.	D.C.	D.C.	B.	B.
	S. C. T	C.	C.	C.	C.	C.T.	T.	S.	C.	C.	C.	C.	C.T.	T.	S.	C.	C.	C.	C.	C.T.	T.	S.
	N. or C.	C.	C.	C.	C.	C.C.	C.	N.	C.	C.	C.	C.	C.C.	C.	N.	C.	C.	C.	C.	C.C.	C.	N.
Period.	Days	365	365	343	365	365	365	365	31	31	31	31	31	31	31	30	30	30	30	30	30	30
					-1897-						-Janu	ary.	1897-					Septe	mber,	1897-		
Load Factor.	Per Cent	33⅓	22.3	33.6	46.4	34.8	52.2	47	33⅓	30	50.6	58.6	46.4	64	48.4	33⅓	17.7	28	43.2	27.6	42.6	43
	Per Cent. of S	----	67	101	139.5	104	157	141	----	90	152	176	140	192	145.5	----	53.2	84	130	83	128	129
Labor.	Shifts	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Duration	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
	Shift-hours	8,760	8,760	8,232	8,760	8,760	8,760	8,760	744	744	744	744	744	744	744	720	720	720	720	720	720	720
	Men per 1000 k. w	1.94	4.67	2.91	3.36	1.9	4.79	5.95	1.94	4.66	2.95	3.24	1.93	4.93	6.36	1.94	4.96	3	3.8	1.77	4.5	6
Cost in Cts	Rate-pay	27	26.8	25.7	25.8	28.6	26.6	25.3	27.	26.5	26.2	25.	29.	25.8	25.6	27.	25.	25.6	24.4	28.4	27.6	24.2
	Per k. w. hour	.157	.56	.223	.187	.156	.243	.321	.157	.41	.153	.138	.121	.198	.336	157	.705	.273	.215	.182	.292	.338
	Per Cent. total op	27.	46.7	32.5	29.4	22.6	28.7	29.1	27.	47.	27.2	23.	18.3	26.8	27.7	27.	51.4	40.6	32.5	25.9	31.8	31.7
	Per Cent. S	----	356	142	119	99.1	154	204	----	261	97.4	88	77	127	214	----	448	174	137	116	186	215
Fuel.	Lbs. per k. w. hour	2.2	3.18	2.48	2.61	2.86	3.24	4.13	2.2	3.07	2.36	2.65	2.74	3.19	4.74	2.2	3.3	2.34	2.48	2.84	3.3	4.05
	Price per short ton $	3	2.6	2.62	2.6	2.72	2.6	2.9	3	2.75	2.65	2.54	2.88	2.71	3.08	3	2.48	2.56	2.53	2.43	2.56	2.44
	Kind, A or B	B.	.3 A. .7 B.	.25 A. .75 B.	.3 A. .7 B.	B.	.2 A. .8 B	B.	B.	.3 A. .7 B	.25 A. .75 B.	.3 A. .7 B.	B.	.2 A. .8 B.	B.	B.	.3 A. .7 B.	.25 A. .75 B.	.3 A. .7 B.	B.	.2 A. .8 B.	B.
Cost in Cts	Per k. w. hour	.33	.414	.325	.340	.389	.42	.599	.33	.421	.313	.337	.395	.430	.729	.33	.409	.299	.314	.345	.423	.494
	Per Cent. total op	57.	34.5	47.4	51.6	55.2	49.7	54.3	57.	42.	55.6	56.4	59.9	58.4	60.1	57.	29.8	41.3	47.5	45.8	46.1	46.4
	Per Cent. S	----	125.5	98.5	103	117.5	127	182	----	127.5	94.5	102	120	130	220	----	124	91	95	104	128	140.5
Repairs, Supplies & Supt. & Gen. Exp.	Per k. w. hour	.093	.225	.128	.132	.159	.182	.182	.093	.172	.0975	.123	.144	.109	.147	.093	.258	.102	.133	.176	.203	.233
	Per Cent. total op	16.	18.8	20.1	20.	22.6	21.6	16.5	16.	17.	17.2	20.6	21.81	14.8	12.2	16.	18.8	15.1	20.	25.1	22.1	21.9
	Per Cent. S	----	242	148	142	171	196	196	----	185	105	132	155	117	158	----	278	110	143	189	218	250
Total Oper. Cents.	Per k. w. hour	.58	1.198	.686	.659	.704	.845	1.102	.58	1.003	.563	.598	.66	.737	1.212	.58	1.372	.674	.662	.703	.918	1.065
	Per Cent. S	----	205	118	114	122	146	190	----	172.5	97.	103	114	127	208	----	236	116	114.5	121	157	184
Fixed Charges	Per k. w. hour	.405	----	----	----	----	----	----	.405	----	----	----	----	----	----	.405	----	----	----	----	----	----
	Per Cent. total op	70	----	----	----	----	----	----	70	----	----	----	----	----	----	70	----	----	----	----	----	----
	Per Cent. S	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	Grand Total	.985	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

S, for standard station; following down the column, first comes the capacity expressed in multiples of 1,000 KW., 3.6 meaning 3,600 KW. The number of units of engines 3, ditto for generators 3, number of units engine per 1,000-KW. capacity is .83, obtained by dividing 3 by 3.6; ditto for generators .83. The next line under type is a description as to whether the engines are belted or direct connected to the generators, *B* for the former and *D C* for the latter. The two lines marked *S C T* and *N* or *C* refer to engines, simple, compound or triple, non-condensing or condensing, as in standard *C C* is compound condensing.

The period during which the averages are taken is given in days. Load factor is in per cent. Inserted in the proper place under costs are the per cent, *S*, and per cent total, which figures represent the per cents the items bear to the corresponding ones for standard and to the total operating expense respectively.

The number of shifts, duration in hours and shift hours, together with the rate of pay of men in cents per hour and number of men per shift per 1,000-KW. capacity, complete the data necessary for the analysis of the cost of labor. Costs are all expressed in cents per KW. hour. Opposite fuel, pounds of coal per KW. hour and price, which is dollars per short ton, give the necessary figures to analyze the cost of fuel per KW. hour. Kind *A* or *B* refer to anthracite or bituminous.

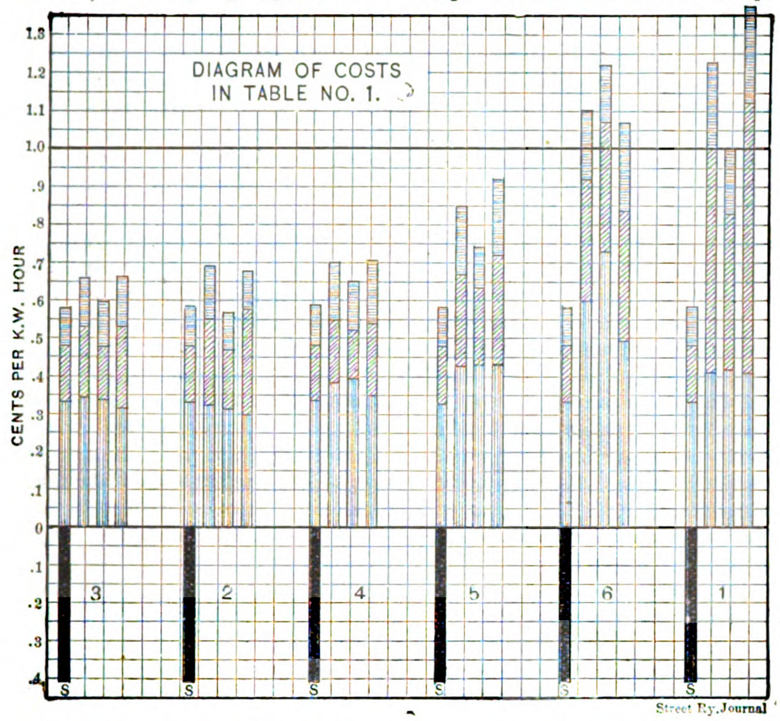
Repairs, supplies other than coal, that is, water, oil, waste, lamps and miscellaneous, as well as superintendence and general expenses, are treated as one item, hereafter called general expense.

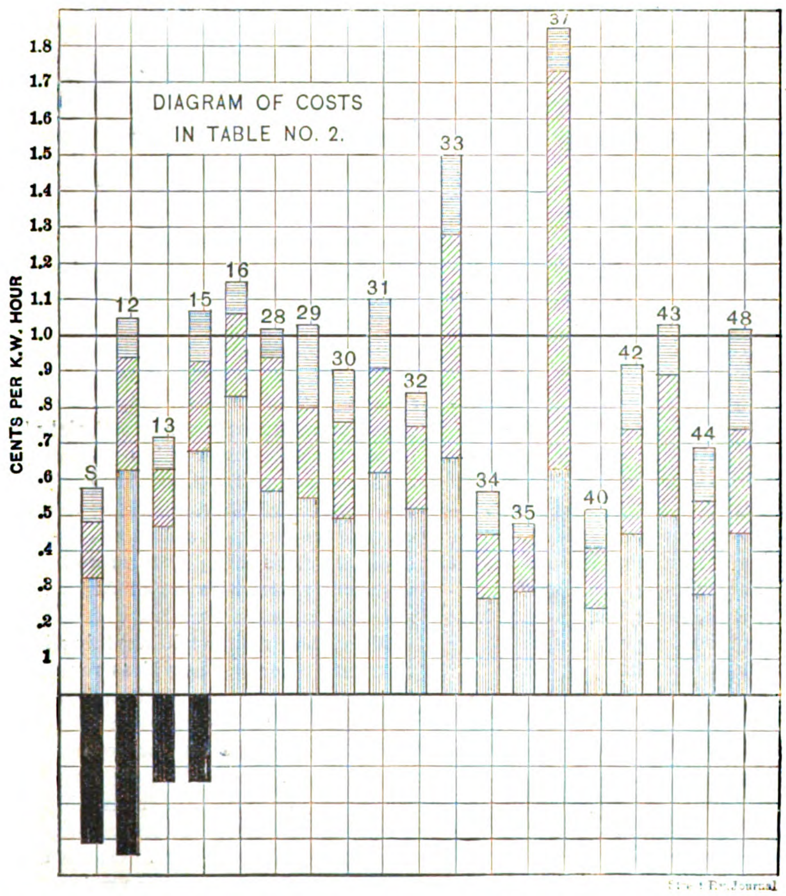
As a supplement to the tables, in order to more clearly illustrate the relation of the costs, I have constructed diagrams in which these are represented by different characters of lines as to shading.

It will be noticed that these shaded lines are of various heights, their height corresponding to the cost of power in cents per KW. hour. Three kinds of shading are used: horizontal, equaling the cost of coal; vertical, the cost of labor, and diagonal, gen-

eral expense. These, which are operating expenses, are laid out above the line, and black, equaling fixed charges, is plotted below the line. The distance from the base line 0 up to 1 represents 1 cent. and the magnitude of each item is denoted by the length of its shading. The diagram for Table No. 1 is laid out in six groups, one group for each station. The first or left hand column in each group represents the costs for the standard station. You will notice that its total length, including the black, is about equal to the distance between 0 and 1, so that, including fixed charges, the cost of power per KW. hour per annum for the standard station amounts to about 1 cent. It also appears that the fixed charges are approximately equal to the coal. Labor is roughly about half the coal, and general expense about half the labor. These proportions are easily remembered, and we might expect them to hold approximately for stations under similar governing conditions.

(*To be continued.*)





INSPECTION AND TESTING OF MOTORS AND CAR EQUIPMENTS BY STREET RAILWAY COMPANIES.*

BY F. B. PERKINS.

In discussing this subject I have decided to speak of inspection and testing separately. The work of inspection is to be attended to principally in the car houses, with a small amount of attention while cars are in service. The testing is to be done in the repair shop. In no direction can a railway company save money or increase dividends more rapidly than by having its equipments thoroughly inspected by competent men, working systematically under intelligent direction. After a car has been through the repair shop and is again placed in service it is naturally supposed to be in first-class condition. It comes then under the immediate supervision of one or more men, presumably the day and night foremen, whose duty it is to keep that car in good condition for so long a time with as little expense as is possible. These men should be thoroughly acquainted with every detail of that car. Instead of examining cars once in thirty or sixty days a daily inspection is necessary. I have thought it expedient for the purpose of setting forth my views on inspection to describe the work as being carried out in a modern car house containing fifty equipments, and arranged for the easy handling of the cars, so that no extra help will be required for that purpose.

In dealing with the inspection of cars in this car house, we believe better results can be obtained by giving to each man some particular branch of the work, rather than assigning to him a certain number of cars and expecting him to do all the work required thereon. For instance, it is safe to assume that the controllers will be kept in better condition if the responsibility of a good repair be placed with one man only than would be the case were this branch of the work made a part of the duties of several workmen in conjunction with all other repairs found necessary. If this be true in regard to controllers it will be found equally pertinent to all other items of car inspection. There is also this advantage—the men will carry the tools and material for one particular kind of work only, whereas if they had a multiplicity of duties to perform it would necessitate their having a large assortment of tools and material or wasting considerable time in going back and forth to the stock room.

In this modern car house five men will be required. This estimate includes only the repair men proper, and not the foreman of the car house, whose duties in connection with handling of motormen and conductors, sending out cars and similar work, would require so much of his time that he could only have a general knowledge of the work of inspection in the car house. Two of this number would be required to grease and inspect the motors; one to keep the controllers in repair, one to take care of the trolleys and to assist in the care of trucks and car bodies, one to have charge of the trucks and car bodies.

The most vital parts of the equipments are the different parts of the motor, viz., armatures, fields, bearings, brushes and brushholders. The care of this part of the equipments should come under the head of greasing, and on the manner in which this part of the work is done depends to a large extent the frequency with which the cars will break down while in service, and also the amount of repair necessary to keep them in operation. Oftentimes the most ignorant and cheapest men are given the place of greaser. On the contrary it is a position where intelligence and thoroughness are imperative. In order that he may have sufficient time for thoroughness in detail, he should not be expected to ring alarms or attend to other matters of a miscellaneous nature, but should be held responsible for his own particular work.

The car should pass into the greaser's hands the first day after it is on the road and every second day thereafter. He should examine thoroughly brushes, brushholders, gears, pinions, bearings and commutator. Of these parts the care of the bearings and commutator is the most important, and should therefore receive the greatest amount of attention. The manner of caring for the bearings is very simple. They must be well supplied with grease or oil, and care must be taken that they are kept free from dust and grit, and also that the grease feeds properly.

In the matter of the care of commutators, electricians seem divided in their opinion as to whether they should be sand-papered or not; personally, I am not in favor of it. Instead of temporizing the commutator by sand-papering it, and thereby simply putting it in shape for one more day's work, I would get at the bottom of the trouble, and either make a

* Read at the Convention of the American Street Railway Association, Boston, Sept. 6-9, 1898.

commutator, by some preparation of mica and copper, which will not spark, or if the trouble lies deeper, remedy it by remodeling the entire motor. This may seem to be a heroic measure, but the end will justify the means. I think, however, that usually the trouble is not in the commutator, nor with the motor, but in either the brushes or brush-holder, or both, and it is probable that with proper adjustment and with proper care and treatment we should find the trouble obviated and sand-papering of commutators unnecessary. When speaking of the treatment of brushes we refer to a treatment of oil or something similar.

The writer has personal knowledge of a large road where common brushes were used without any treatment or care except to replace them as needed, and it seemed as if the man who used the most brushes was given the credit of taking the best care of his motor. The average life of brushes on this road and the above conditions with the commutator sand-papered every day was six days. Subsequently the sand-papering was stopped entirely, and the brushes were removed every six days and properly treated in oil. The life of brushes under this treatment was increased from six days to from forty to sixty days. The trouble with commutators, which before had been great, was reduced to a minimum, in fact, almost entirely averted. It is possible that under some heavy conditions the practice of sand-papering must be kept up, but it must be accomplished in a different manner, and, instead of indiscriminate sand paper, it must be applied sparingly.

Not later than every fourth day every controller and switch comes under the notice of the man who has charge of those parts. The main point is to clean thoroughly, using a little vaseline on the contacts. The parts that are worn should be touched up with a file, or should be sand-papered, and if badly worn should be replaced, so that at least every fourth day the controllers will be sent out in first-class condition. This man can also examine the car wiring, lamp fixtures, headlights and all similar parts.

The fourth man will have the care of the trolley poles and wheels. These should be carefully looked over each night and oiled if necessary. The man who attends to this part of the equipment will also have considerable time to devote to general inspection of the car bodies and trucks under the direction of the general inspector. Under the scrutiny of these two men should come all the details of the car body, such as grab handles, window catchers, curtain fixtures and similar parts. These should be carefully attended to each day, insomuch as the reputation of the road will suffer in direct proportion as the attention to these small details is neglected. For the public is exceedingly exacting as regards the manner in which its comforts are catered to in these minor details, and the degree of excellence which characterizes this part of the work will be largely instrumental in molding and fashioning its opinion of the road and of its servants in management.

The matter of car cleaning will not be considered in this paper, as it is not directly connected with the subject in hand.

After having touched upon the subject of the matter of inspection in the car house we have to deal with outside inspection, that is, inspection on the road by inspectors, motormen and conductors. It may be a good plan to have outside inspection, and it is often advantageous, if not carried too far, but I do not believe it is desirable to have a large force, for this reason, but very little of the time devoted to this line of inspection is really used in looking over the equipments, but must necessarily be consumed in getting from one car to another and in waiting for opportunities, and most of the trouble located by these inspectors is not of such a nature as to require immediate attention. If it were, the inspector could not make the necessary repairs without taking the car to the car house.

Troubles of a serious nature, such as would require immediate attention and taking the car out of service, should be easily detected by the motorman or conductor, and reported at once to the proper official. It may not be entirely irrelevant to speak here of the relation of motormen and conductors to the inspection of cars. It has been proven that it is usually a waste of time and very little has been accomplished by attempting to instruct motormen and conductors in other than the simplest ideas of electrical problems, for while on some roads there may be a number of old motormen who have a fair idea of electrical equipments, and whom it would probably be safe to allow to locate existing trouble, it would be difficult to draw the line between the men competent in this direction and those wholly lacking in such knowledge. I know of nothing more distasteful to passengers unwillingly detained than sitting in a car impatiently waiting while a motorman works over some part of the equipment in a vain endeavor to locate some trouble, the very nature of which he has not the faintest idea, and quite likely, at the same time, interfering with the movement of several other cars.

Of course, contingencies might arise where men would be justified in attempting to locate trouble on their cars, but as a rule they should not be allowed to do so, as the practice is wrong. If they clearly understand the brake mechanism, the right manner in which to apply the power to the motors, how to use the cut-out switch in the controller, and have a clear conception of the general rules as promulgated by the company, this will be about as far as it is profitable to teach them.

But while we may not allow them to make repairs or experiment with the equipment we must educate them to the necessity of being able to immediately detect any unusual or threatened condition, and to at once report the same. In fact, they must be made to feel that it is their first duty to report everything that is working to the possible detriment of the company, and if we properly impress them with the importance of these details as outlined above we shall have established a means of quickly locating trouble on the road, and that without the aid of special inspectors.

Next comes the matter of testing. The service which we will obtain from our equipments depends largely upon the manner in which the repairs are made. If the repair work be rushed through with the idea of going over as many cars as possible in a short space of time, and with little or no regard for the thoroughness of the work, we must expect the necessity for repairs to increase to an alarming extent. If, on the other hand, we make our repairs with the idea that work thoroughly done will have a tendency to greatly decrease the liability to break-downs while the cars are in service, and correspondingly reduce the amount of work to be done in the repair shops, we shall naturally consider the best means not only of doing the work, but of definitely determining its condition when finished. To do this properly we must resort to our testing, and we use the word "testing" in a broader sense than it usually signifies. For example, all material furnished, such as tape, mica, paper, etc., must be kept up to the standard, and to accomplish this everything used should be carefully examined, or, under our classification, tested.

We must begin testing in the purchasing department. In the purchasing of supplies a great deal of trouble is often occasioned by changing the kind of material furnished. This is probably more noticeable in the case of small roads. Now, while there may be no great difference in the quality of goods furnished, or if any one of the many different kinds were used exclusively, it would give satisfaction, yet the very fact that many different kinds are used has a tendency to produce a lack of carefulness in the details of the work which will almost invariably show in the general result. This will be noticeable in several ways. The workmen will take one of the following views of the matter. He will either think the management is careless in the matter, and as a consequence he will immediately commence to drop from the former high standard of work, or he will think that there is nothing essential about the quality of the material used, and acquire the pernicious habit of utilizing anything which may happen to be handy.

When a workman once detects what seems to him to be a lack of thoroughness in any part of the work which has to do with his department, you have at that moment allowed to enter that department a spirit of carelessness which will develop very rapidly and unless quickly suppressed will produce disastrous results in a short time.

To attain to a condition of thoroughness in any line of work may have called for the performance of a great deal of hard labor, the expenditure of much time and money, and the exercise of patience, skill and forethought, but how slight a relaxation of vigilance on the part of some official trusted with the maintenance of the good condition acquired can undo in an incredibly short space of time the good work accomplished, and cause a retrograde movement along lines which had promised so favorably.

If, however, we have to allow only one kind of material in the repair shop, the question naturally arises as to how we can avoid being behind the times in the matter of different kinds of supplies, and also in the manner of their use. The answer is, we must have an experimental room, and here must be tested samples of all supplies and material before being contracted for by the purchasing agent. I do not mean to say that this room must necessarily be separate from the repair shop, as this would naturally require a large amount of machinery which we already possess and would not care to duplicate. But this room must be considered by the employes as one in which they are not directly interested other than as they are required to work on some portion of that which is being tested, but the special testing and all the instruments for the same must be in a separate department, and if it is not possible to have a separate room, at least a part of the repair shop should be partitioned off for this work, as the amount of time wasted by the employes of the shop attracted from their regular duties by the testing of some part of equipment or material on the floor of the repair shop proper, would, if saved, more than compensate for the expense incurred in the creation and maintenance of such a room.

Having thus arranged this separate apartment for practically all testing purposes, and having impressed upon employes and workmen that herein will be settled all questions relating to work done and material used, we have accomplished one of the results aimed at, in that we have prepared ourselves to impress upon the men that any material placed in their hands for use in repairs has previously been thoroughly tested, and this, we think, will tend to raise the standard of work, as any results of poor workmanship on their part cannot then be laid to faulty material. This will give them an incentive to conscientiously deal with established and known good material.

We are now able to take anything in the line of new material or any new ideas regarding the use of the same, or any electrical problems which may arise, and ascertain their value without interfering in any way with the regular work of the shop or of the employes.

It is neither necessary nor desirable that the workmen should know the merits or defects of whatever comes to the testing room. On the contrary, there are some of the employes who should be allowed to become familiar with a great deal of the work of this room. They will not only be more valuable for the knowledge thus obtained, but some of the work must of necessity be delegated to some other person than the electrical engineer. But at all times it must be made plain to them that the room is dis-

tinctly a separate department, having no connection with their ordinary work.

Having now provided for our testing department and established its relation to the purchasing of supplies and to the employes of the repair shop, what machines and instruments shall we need in its equipment?

A high and low reading direct-current voltmeter, one having a double scale reading from 1 to 750 and from 1 to 15.

A direct-current ammeter reading from 1 to 100.

A low reading ammeter would be very convenient many times, but is not absolutely necessary.

A 50,000-ohm magnetic bell.

An alternating current voltmeter and some handy testing set will make an outfit of instruments with which we can do all the testing required.

If the alternating current is not within reach of the car house we must procure a small dynamo, and produce it ourselves. A very small machine, say 2 HP., would be sufficient for all the needs of the testing department. If this machine is designed for about 100 volts it would be most convenient for our use. With a few small transformers wound for 2,000 volts primary and for either 50 or 100 volts secondary we are prepared to furnish any voltage within a range of from 5,000 to 10,000 volts.

The man who has this part of the work in charge can very easily and cheaply arrange the details of installation of the wiring, etc. He can also make some resistance coils and many other pieces of apparatus which will greatly facilitate the quick testing of whatever may be sent to this department.

What shall we test? First, everything that goes into the repair shop. By doing this we shall be sure of keeping all material up to the standard, which means an absolute guarantee against breakdowns caused by poor material. In this way we raise the standard of workmanship.

Second, all supplies which go to the foremen of the car houses. In connection with this matter we are of the opinion that in the testing room should be decided the manner of treating brushes, the length of time they should be used before being removed from the motor, the manner in which they should then be cared for, their final disposition, the proper attention to be given the trolley poles, the length of time they ought to remain in service, their condition when removed, and many other similar questions should not be left to work out their own solution or dependent upon the feelings or judgment of the various employes and workmen, but should be definitely determined and decided in our testing department.

Many may be of the opinion that we are carrying system beyond necessary limits in thus definitely and positively arranging these details, but why should we allow several different men to use material in whatever manner they may individually see fit, to treat brushes as their fancy may dictate, to regulate the tension of trolley poles in accordance with their own feeling at the time rather than by any fixed standard, and various other matters which might be mentioned along these lines?

Third, all finished material, such as armature coils, insulation for controllers, commutators and brush-holders. We do not necessarily need to test every piece, but enough to satisfy ourselves that the general order of work is kept up to the standard.

Fourth, all armatures, fields, commutators and controllers, as they are being made or repaired. One illustration will be sufficient to show how the testing may be carried on in this branch of work.

An armature is wound and ready to be connected to the commutator. With a small wire we connect all of the top leads together, with the bottom leads each separate from the other. With a magneto or testing set we find the insulation of the complete armature is not right. First we cut the small connecting wire on the top leads in several places, then by testing each of these parts we locate that portion of the armature which is bad; then by removing the wire we will test each coil separately until we find the weak one. Next, by the use of our transformers we obtain 3,000 or 4,000 volts, which we apply to this one coil. If it stands the test we may allow it to go through, and if not, it can be replaced. If we should find that the trouble extended to a large portion of the armature and indicated moisture in the coils, we may, by the use of this same transformer, obtain 25 or 30 volts, and by connecting the armature to the commutator with the exception of one end of one coil, then connecting one side of the 25-volt circuit to this end, and the other side of the circuit to the commutator or bar left vacant, we may apply the current for the purpose of drying the armature. With this advantage the heat will be generated in the core, and the armature will dry from the inside instead of from the outside.

With similar tests on all finished parts sent out from our repair shop we have almost wholly removed the chances of failure in service, and have unquestionably added to the length of life which may reasonably be expected from our equipment.

By running a few wires from our testing room to that part of the shop where the cars are brought in for repairs we are able to reach every part of the equipment in a quick and thorough manner, and it is probable that if a few tests are made on every car that comes to the shop many troubles will be located before they have sufficiently developed to become serious. Hence, the time required to make tests will add nothing to the pay roll, while the benefits derived may be many. All cars should be brought to the repair shop, thoroughly overhauled and inspected at least twice a year.

In determining what shall be the standard of the work in the different branches of the shop, or finished material, and of cars in service, I do not believe there can be any fixed scale. But that, as we proceed with our testing and inspection, we shall gradually raise the standard of our work, and it will only be a short time after adopting a thorough method of doing the work that many of the daily perplexities will have been eliminated.

The New President.

Charles Spencer Sergeant, the new president of the American Street Railway Association, was born in Northampton, Mass., in 1852. His father was born in Stockbridge, Mass., which has been the family home since the settlement there in 1735 of his great-great-grandfather as a missionary to the Stockbridge Indians. The new president was educated in the public schools of Northampton and was graduated from the high school in 1868. In that year he began his business career in the employment of the First National Bank of Easthampton. In 1872 he entered the steam railroad business as paymaster and cashier of the Marquette, Houghton & Ontonagon Railroad Company and was also associated with various iron companies and engaged in the iron smelting business. In 1876 he went to Boston to take the position of chief clerk of the Eastern Railroad Company, subsequently being appointed general auditor. In December, 1887, when the West End Street Railway Company came into possession of the several street railways centering in Boston, he was offered and accepted the position of general auditor of the company, subsequently being made second vice-president, and in November, 1892, he was appointed general manager of the West End, which position he held until its lease to the Boston Elevated Railway Company, of which company he is now second vice-president.

It will be seen from the record here given that Mr. Sergeant is well equipped for his new position as far as practical experience in street railway and business matters is concerned, and his personal merits are so well known in the Association that we need not refer to them further than to say that he is held in high esteem by the members.

THE FIRST ELECTRIC MOTOR.

Editor ELECTRICITY.

Permit me to further elucidate and correct an article copied from the Chicago *Record* respecting the first electric motor, in which an "out" was plainly apparent. It said the electric motor was the invention of Thomas Davenport, "an ordinary blacksmith, going to perform with the force and energy wrapped up in galvanic magnetism. Ignorant of mechanics he enlisted the aid of Andrews and Smalley, both practical machinists, and the latter the inventor and maker of an automatic machine for cutting the screw threads on nuts and bolts."

As stated above, Mr. Davenport was a common blacksmith at Brandon, Vt. In December, 1833, he went to Crown Point, on Lake Champlain, to get iron for use in his shop. There he saw for the first time an electro-magnet which was in use at the Iron Works for extracting iron from pulverized ore. Though it weighed but four pounds it would suspend a weight of one hundred and fifty pounds. It attracted his earnest attention. Though he had never heard of such a thing, he instinctively saw in it force and energy. He purchased it instead of the iron he went after, took it home, declaring to his neighbors, amid their jeers, that from it he could get power enough to move the largest boats on the lake. He abandoned his forge, and with the aid of Andrews and Smalley, for he did not know the name of a single part of the apparatus, he succeeded the following year in perfecting rotary motion and a motor.

It was in 1836, if memory is correct, that Mr. Andrews (not Mr. Smalley) at the Iron Works, Forest Dale, three miles from Brandon, invented a machine for cutting the threads on bolts and nuts and making the heads on bolts automatically, and the machines were in constant use there. No patent was secured for it and it became of common usage.

In my former article it was stated that while Davenport was developing his motor he and Smalley ran a wire between their residences, over which they sent and received messages. Is it not possible that herein lies the actual discovery of the electric telegraph or the telephone? Whether they used a system of sounds to signify words, or a diaphragm, cannot now be determined. L. F. ANDREWS.

Des Moines, Iowa, Sept. 11.

Prof. R. B. Owens' Successor.

The friends of Mr. Morgan Brooks of Minneapolis will be pleased to learn that he has been appointed Professor of Electrical Engineering in the University of Nebraska, at Lincoln, to succeed Prof. R. B. Owens, who has accepted a professorship in McGill University, Montreal. Mr. Brooks is a graduate of Brown University, class of '81, and of Stevens Institute, class of '83, and is well qualified in every respect to fill his new position. The Electrical Engineering Company of Minneapolis, of which Mr. Brooks is president, will not be affected by his appointment, as he will retain his interest in that company and remain its president.

The Street Railway Accountants' New Officers.

The following are the officers elected for the ensuing year by the Street Railway Accountants at their recent meeting in Boston:

President—J. T. Calderwood of Minneapolis.
First Vice-President—E. R. Tighe of New York.
Second Vice-President—R. S. Williams of Richmond, Va.
Third Vice-President—F. E. Smith of Lynn, Mass.
Secretary and Treasurer—W. B. Brockway of Toledo, O.
Executive Committee—H. L. Wilson of Boston, chairman; H. E. Babcock of Elmira, N. Y., H. O. Mackay of Milwaukee, and J. N. Fraser of Ottawa, Can.

The Association decided on Chicago for its next annual meeting, which will be held simultaneously with that of the American Street Railway Association.

ANNUAL MEETING OF THE STREET RAILWAY ASSOCIATION OF NEW YORK.

The sixteenth annual meeting of the New York Street Railway Association was held at Manhattan Beach Hotel, Coney Island, on Tuesday and Wednesday of last week. About thirty electric railways, whose capital stock would aggregate probably $300,000,000, were represented, and a large number of supply men were on hand to show the magnates and managers how to augment their dividends and the efficiency of their lines by the adoption of whatever apparatus or appliance they were there to extol.

The President of the Association, G. Tracy Rogers of Binghamton, in his opening address complimented the Executive Committee for the manner in which they had conducted the affairs of the Association during the past year, and spoke at length on the progress made in improving the street railways throughout the State. He referred particularly to the changes made in New York City, and alluded to the rapid construction of lines in the metropolis as a noticeable feature in street railway history.

The papers presented at the opening session were: "Signal System for Single Track Railroads," by H. S. Cooper of Schenectady; "By-Products at Power Stations," by Dr. H. M. Fenner of Fredonia; "Track Building," by R. P. Brown; "How to Develop New Traffic on Street Railroads," by H. Milton Kennedy of Brooklyn. The latter paper was listened to with close attention and was followed by an interesting discussion which was participated in by several members.

Mr. Koran Sugahara, of Japan, who produced such a favorable impression by his remarks at the Street Railway Convention in Boston, was introduced to the delegates and made a brief speech in which he detailed what had been done in the railway line in his own country, and pointed out the advantages Japan offered for American enterprise.

In the evening, after the visitors had witnessed the "Fall of Manila" and Pain's fireworks, the delegates and their guests sat down to a banquet in one of the large rooms of the Manhattan Beach Hotel and had a merry time, Tom L. Johnson acting as toastmaster. Among those who were called on to speak was President Vreeland of the Metropolitan Street Railway, whom the toastmaster referred to as "the embodiment of sixteen railroad presidents in one," alluding to the number of companies that had been absorbed by the Metropolitan. Several of the toasts were responded to in a witty manner and the whole affair was as pleasant as one could wish.

The reception committee consisted of Clinton L. Rossiter, president of the Brooklyn Heights system; Albert L. Johnson, president of the Nassau system, and John L. Heins, president of the Coney Island Railroad.

On the 14th the Association elected officers, visited the Navy Yard, Brooklyn, and were treated to a sail around the harbor on the steamer Hudson, an elaborate luncheon being served on board.

The officers elected for the ensuing year are:

President—G. Tracy Rogers, Binghamton (re-elected).

First Vice-President—W. Caryl Ely, Niagara Falls (re-elected).

Second Vice-President—Albert Johnson, Brooklyn.

Secretary and Treasurer—Henry A. Robinson, New York (re-elected).

Executive Committee—H. H. Vreeland, New York; John W. McNamara, Albany; Henry M. Watson, Buffalo; Clinton L. Rossiter, Brooklyn.

It was decided to hold the Convention next year at Ithaca.

The American Electro-Therapeutic Association.

The Eighth Annual Convention of this Association was held at Buffalo on the 13th, 14th and 15th inst. Several important papers were read at the meeting, all tending to show that the use of electricity, especially in surgical operations, is proving of incalculable benefit both to the practitioner and the patient, and is being introduced into almost every branch of surgical practice. Alluding to this, the president of the Association, Charles R. Dickson, said: "One has but to glance at the programme to see to what extent electricity may be used, and used to advantage. A programme such as ours should prove a perfect revelation to him who has not kept well up to this progressive age."

Some amendments were made in the constitution and by-laws of the Association.

On the evening of the 14th Dr. Lucien Howe gave a reception to the members at his home in Buffalo, and on the following day they enjoyed a steamboat excursion down the river and a dinner at the Island Club House.

The following officers were elected:

President—Dr. Francis B. Bishop of Washington, D. C.

First Vice-President—Dr. Ernest Wende of Buffalo.

Second Vice-President—Dr. W. H. White of Boston.

Secretary—Dr. John Gerin of Auburn, N. Y.

Treasurer—Dr. Richard T. Nunn of Savannah, Ga.

Executive Council—Dr. Robert Newman of New York and Dr. G. Belton Massey of Philadelphia, three years; Dr. A. D. Rockwell and Dr. William J. Morton of New York, two years; Dr. Charles R. Dickson of Toronto and Dr. Frederick Shavoir of Stamford, Conn., one year.

The next annual meeting will be held in Washington, D. C., on September 19, 20 and 21, 1899.

LEGAL NOTES.

Where one was killed by stepping on a charged electric wire, which was broken in two and lying on the ground in an alley, the electric light company was held by the Supreme Court of Missouri to be *prima facie* negligent and liable. Gannon vs. Laclede Gaslight Co.

A city which has permitted an electric street car company to occupy its streets for five years without objection cannot thereafter object. State vs. Spokane St. Ry. Co., Wash. S. C., 53 P. 719.

The fact that a wire charged with a dangerous current of electricity fell and caused injury is held by the West Va. Supreme Court to make a *prima facie* presumption of negligence, but not a conclusive one, as the misfortune may have occurred from unavoidable accident.

The Indiana Supreme Court decides that a telephone system may be owned and controlled by an individual person, notwithstanding the grant by the Legislature of such rights to corporations. An individual may conduct any proper business without Legislative assent, unless there has been some Legislative restriction upon such right.

A decree pro confesso was entered at Galveston, Tex., on the 5th inst., against the Citizens' Electric Light Company for failure to answer to the complaint in the suit brought by the Massachusetts Loan & Trust Company.

The Electric Storage Battery Company of Gloucester, N. J., has filed in the United States Court at Wilmington, Del., a petition asking for an injunction to restrain the Wilmington City Electric Company from putting in its proposed storage battery plant. The Storage Battery Company alleges that the Wilmington concern is infringing on patents it holds. Judge Bradford granted a rule ordering the Wilmington City Electric Company to appear in court on October 12 and show cause why a temporary injunction should not be granted.

In the suit of the Electric Car Company of America and the Thomson-Houston Electric Company against the Walker Company, Judge Lacombe, in the United States Court, New York, last week, suspended the injunction previously granted and the defendants are permitted to use all apparatus now in actual possession and to sell all apparatus contracted for. The injunction is also suspended as to the manufacture of new apparatus. This suspension is to continue until one month after the opening of the next session of the United States Circuit Court of Appeals for the Second Circuit, in order to give the defendant an opportunity to secure a review of a previous decision.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILWAYS.

Asbury Park, N. J.—Contracts for right-of-way are being made for a trolley road running from Atlantic Highlands to this city. The road will run from the Highlands to North Shrewsbury, thence to Navesink, Fairhaven, Little Silver, past Elkwood Park, Long Branch, West Long Branch, Interlaken to West Asbury Park. The excursion fare between Asbury Park and New York will be $1.

Beaumont, Tex.—A company of local capitalists have sent a petition to the city council asking for an electric street railway franchise. They agree to begin work within twelve months from the time the franchise is granted.

Bellows Falls, Vt.—A notice conforming to the law has been issued in relation to the application to be made this fall to the Legislature for a new charter for an electric railroad to run from Bellows Falls through Saxtons River to Grafton. The notice is signed by Ransom E. Smith of Saxtons River, who has been an active mover in the negotiations of the past six years for a road between here and Saxtons River.

Biddeford, Me.—As a result of a favorable report by experts who went over the route on a tour of investigation, work on the Saco River Electric Railway will be started before the end of the month. The contract for the construction of the road has been given to Boston contractors.

Chattanooga, Tenn.—President Divine has decided to equip the suburban lines of the Chattanooga Rapid Transit Company with electric cars.

Denver, Col.—The ordinance permitting the Denver City Railroad Company to change the motive power of its cable road to electricity, vetoed by the mayor, has been passed over the mayor's veto by the board of aldermen.—The owners of the cog road running up Pike's Peak have decided to change the motive power from steam to electricity. It is estimated that the cost of making the change will be about $50,000.

Leavenworth, Kan.—An ordinance has been introduced in the city council granting a franchise for the Leavenworth and Kansas City Electric Power & Mining Company. This is for the proposed electric road between Leavenworth and Kansas City that has been under consideration for some time. It is proposed to furnish electric power cheap to Kansas City factories, and also to haul coal over the road at night. A route to Kansas City was surveyed and the right of way secured last spring.

Lewiston, Me.—The Lewiston, Bath & Brunswick Electric Railway, which has just been completed, has been inspected by the railroad commissioners and pronounced by them the best system in Maine. In speaking of the success of the road, I. C. Libby, of Augusta, the chief promoter of the railway, said that the earnings of the road at the present time are between $1,000 and $1,500 a day, and that the promoters are well pleased with what they consider to be the finest electric railroad system in New England with the exception of the West End Company of Boston.

Millbury, Mass.—Work is in progress upon the construction of the electric road from Grafton to Worcester. The line will pass through North Grafton and Millbury Junction and connect with the Consolidated road's tracks in Worcester. The plan is to have the cars running by November 1.

Montreal.—On January 1 last there were 35 electric railways in operation in Canada, with a total mileage of 583. The number of passengers carried in the year was 83,800,000, as comparing with 16,170,000 by the steam railways on their mileage of 13,000. The paid-up capital of the electric railways in Canada is $18,700,000.

Pittsburg, Pa.—The Consolidated Traction Company is building an immense storage plant on Penn avenue for husbanding surplus electrical power for the various street car lines of the company. The building will be 8 stories high, with 25 feet front and 156 feet depth, giving a floor space of 3,750 feet. The entire building will be used in storing the power in great drums. It is thought the structure will be ready by the 1st of January.

Spartanburg, S. C.—The parties who recently purchased at public auction the property and franchises of the Etna Light & Power Company—A. H. Lezuky, W. E. Lown, G. S. Dunn and E. Norton—propose to take hold of the electric railway to Glendale and Clifton and complete it. The track is already graded beyond Glendale, but nothing has been done to it for two years.

St. Joseph, Mich.—The case of the dissatisfied stockholders who asked for the appointment of a receiver for the St. Joseph & Benton Harbor Street Railway Company has been stricken from the court calendar at

the request of the complaining stockholders, who disposed of their stock to unknown parties.

St. Louis.—The St. Louis, Fenton & Southwestern Railroad Company will erect an electric power plant. Electricity will be generated by water power.

Toledo, O.—The Bonner rail wagon was pronounced a success by all who witnessed a test of it made on the Perrysburg Electric Railway on the 9th inst. The wagon can be loaded in a farmer's barnyard, hauled by horses to the electric railway, placed on a specially constructed car and hauled to the city.

Wichita, Kan.—Petitions for an election to vote on the proposition of municipal ownership of street railway and electrical light plants have been signed here by the requisite number of voters, and Mayor Ross will issue a proclamation for a special election to decide whether bonds shall be issued by the city.

Worcester, Mass.—By the opening of the new electric line between Fayville and South Framingham, Worcester and Boston are connected by trolley, and it is possible to take a Marlboro car and by several changes get into Boston five hours later. The trip costs 60 cents.

LIGHTING.

Atlanta, Ga.—The sub-committee of the executive committee, consisting of one member of the executive committee from each ward, has passed a resolution providing that the question of owning a lighting plant by the city shall be submitted to the people at the city primary on October 5.

Creede, Col.—An incendiary fire destroyed the Amethyst electric power and light plant on the 7th inst. Loss $14,000.

Detroit, Mich.—The public lighting commission has reconsidered its action in ordering advertisements for new bids for 100 arc lamps and globes and awarded the contract to the Adams-Bagnall Electric Company, whose bid of $17.25 per lamp was the lowest. "The commissioners concluded," says the "News," "that they couldn't afford to allow an unsuccessful bidder to come in after bids were opened and, under pretext of making a lower price, secure a readvertisement of the contract."

Fort Wayne, Ind.—The council, by a vote of 15 ayes to 5 noes, has awarded the contract for electric lighting to the Jenney Electric Light Company. The contract is for five years and the rate per lamp $100.

Houma, La.—The council has granted Wilson & Jastremski, proprietors of the Houma Ice Factory, a franchise for fifteen years to operate an electric light and power plant, and they will proceed to erect the plant at once.

Delaware, O.—After a spirited discussion, in which the comparative merits of electric and Welsbach lighting were fully considered, the council decided to award the contract to the electric light company for ten years at $77 a year for each arc light.

McKinney, Tex.—L. A. Scott of Melissa has bought the electric light plant here owned by Henry & Pardeau.

Mt. Pleasant, Mich.—An election is to be held on the 21st inst. to vote on the proposition to issue $20,000 bonds for waterworks and $7,500 for an electric light plant.

Mystic, Conn.—An electric lighting plant is to be established here at once by Thomas C. Perkins of Hartford and associates. Efforts are being made to secure a franchise at Stonington, and if this can be obtained lights for both places will be supplied from the Mystic plant.

New Richmond, O.—At the election held on the 12th inst., the proposition to put in waterworks and an electric lighting plant was carried in the affirmative, 361 to 56.

Pittsburg, Pa.—The superintendent of the Allegheny County Light Company estimates that 250,000 electric lights, including arc lights, will be used for decorations in Pittsburg and Allegheny during the Knights Templars' conclave in October. When the cost of coal, wiring, labor and lamps are considered, the Pittsburg electrical display will eclipse anything attempted before, reaching $250,000 in expenditures.

Quincy, Ill.—The syndicate which owns the Thomson-Houston electric light plant, the street car line and the gas company, has also purchased the Empire Light Company's plant. The Empire Company was capitalized at $100,000.

Salem, Ill.—The city having decided to put in a $9,000 electric light plant, has awarded the contract to T. C. Reed & Co. of Chicago. The plant is to have a lighting capacity for fifty arc lights of 2,000 candle-power, and for commercial lighting 1,500 incandescent lights of sixteen candle-power. The plant is to be owned and operated by the city.

Seabright, N. J.—The power house of the Seabright Electric Light Company at Galilee was totally destroyed by fire on the night of the 14th inst. The loss was about $12,000.

Shelbina, Mo.—At the special election on the 6th, the proposition to issue bonds to the amount of $5,000 for the purpose of increasing the power of the electric light plant was carried by a large majority.

Tipton, Ind.—The Tipton electric light plant has been sold to J. S. Tarkington of Kokomo.

Vancouver, B. C.—In the disastrous fire at New Westminster on the 11th inst., the pole-line equipment, transformers, etc., of the electric light plant, valued at $30,000, were completely destroyed; the power house escaped. A large part of the town was laid in ashes.

Wahoo, Neb.—The local electric light plant was destroyed by fire on the 10th inst., and the loss amounts to several thousand dollars. The plant was owned by S. H. Jones of this city.

Winona, Miss.—The Winona Ice, Electric Light & Water Company has been organized by E. R. Blackston, D. B. Turner, C. S. Harris, William H. Witty and others, one of the purposes being to erect an electric light plant. The capital stock is $100,000.

MANUFACTURING, ETC.

Charlotte, N. C.—The Southern Electrical Company has been incorporated by S. B. Alexander, Jr., and others, who have purchased the electrical department of the Charlotte Machine Company and will operate it independently. Capital stock, $10,000.

Cincinnati, O.—The strike of the machinists of the Bullock Electric Company, which had been going on for several months, has ended in a compromise. Most of the strikers will be re-employed, and will work under the premium system, the introduction of which was the cause of the strike. The plant of the company will be removed to Norwood early in October.

Columbus, Ga.—The stockholders of the Columbus Power Company on the 9th inst. paid in $20,000 under a call for this amount, and the money was deposited in the Third National Bank. The "Enquirer-Sun" says the full amount of stock has been subscribed and payment of same will be called as money is needed to carry on the work of building the plant. All contracts for the building of the plant have now been signed and the work will be carried on as rapidly as money and men can do it.

Philadelphia.—A report to the Philadelphia Commercial Museum from Colombia, South America, states that there is a demand there for electric light fixtures for houses, offices, churches and stores.

Pittsburg, Pa.—The Pennsylvania Tube Works Company is making arrangements for the installation of a complete electric plant at their works in this city for the operation of the entire plant by electricity. The company proposes to expend about $100,000 on the erection of a central power plant of about 1,000 horse power. The electricity will be distributed through the lap and butt weld departments to perhaps 25 motors of 40 HP. each that will be placed near the various machines used in the manufacture of tubes and other productions of the works. The company is now using over 150,000 bushels of coal a month, and it is believed that with electricity it will be possible to secure the same amount of power with 100,000 bushels a month. Other iron and steel manufacturers are looking forward to the results of the change with considerable interest.

Washington, D. C.—The "Star" states that several applications have been received by the Government, through the War Department, for concessions of various kinds in Porto Rico, American capitalists being anxious to invest their money in the construction of steam and electric railroads and gas and electric light plants on the island. Adjutant General Corbin, by direction of the President, has informed one syndicate that sought a concession for the construction of a steam railroad from Ponce to San Juan, that no such proposition can be entertained at this time. The condition of affairs in Porto Rico, the syndicate was informed, is not such as to admit of this Government entering into any arrangement for such a concession as it asked; and until a determination had been reached by the properly constituted authority for the government of the island, no proposition for franchises or special rights in the island can be entertained. It is likely that Congress, in providing a scheme of government for Porto Rico, will provide also for the granting of franchises and rights of way in a manner similar to that now pursued in regard to such concessions in the various Territories of the United States.

MINES, ETC.

Pittsburgh, Kan.—The Western Coal & Mining Company has begun work on the construction of a 125 horse-power electric plant to operate machines at its coal mine, and Superintendent Craig thinks that inside of eighteen months fully 75 per cent. of the mining in this district will be done by machinery.

TRANSMISSION PLANTS.

Kalamazoo, Mich.—The Kalamazoo Valley Electric Company, organized by W. A. Foote, J. B. Foote and C. H. Frisbie of Jackson, R. H. C. Hoagland of Kalamazoo, and S. S. Hurlburt of Battle Creek, has been incorporated with a capital stock of $100,000. The purpose of the company is to develop the water power of the Kalamazoo river at Allegan, and distribute electricity to Allegan, Otsego, Plainwell, Kalamazoo and Battle Creek for power and light.

Tacoma, Wash.—The "News" states that a plan for a water power to be owned by the city has been submitted by C. B. Talbot. The initial scheme is for a power plant chiefly, to be erected on the Cheneius river at the Puyallup canyon, a distance of about 25 miles from Tacoma. Mr. Talbot says a ditch 8 feet deep can be dug to Maplewood Springs, near Puyallup, where he proposes to put in electric machines and run the current into the city for lighting and power. The fall would be 630 feet in the 20 miles, and a horse power of 5,000 to 10,000 could be developed, according to the width of the ditch. This work, Mr. Talbot says, can be done for $100,000, most of it for labor, and the plant once installed, he says, the city should derive a yearly revenue of $100,000 from it, enough to more than pay all municipal expenses and save the levy of any tax whatever.

COMPANY MATTERS.

Petersburg, Va.—In the suit of the Upper Appomattox Company against the Petersburg Electric Railway Company, the Hustings Court has entered an order for the sale of the road on November 10, to obtain money to pay off the liens which have been secured against the company and the bonds, amounting to $50,000, which were secured by deed of trust upon the property.

Syracuse, N. Y.—According to the figures submitted by Assignee Stolz, the creditors of the Electrical Engineering & Supply Company of this city will get about 25 cents on the dollar.

PERSONAL AND MISCELLANEA.

H. T. Eddy of the General Electric works at Schenectady has been appointed instructor in electrical engineering at Union College, to take the place formerly filled by Dr. Brackett.

The Pittsburg "Times" says: "Electricity will probably be used for the first time in the operation of a river dam in the new affair on the Ohio river at Merriman now under construction. The Government engineers have figured for some time on the adoption of this power instead of steam, and it is understood that an electrical plant will be installed as soon as the dam is completed. It has been estimated that a great saving can be made in the operation of the dam by electricity, and it is estimated that the work can be done quicker and with less labor. The motor arrangement at the lock gates will be simple and involve only a question of push and pull. The apparatus on the wickets will be a novel affair. A small motor will be arranged on a traveling crane, and this will travel back and forth and quickly lower or raise the wickets. This is now a slow and laborious process that is often attended with danger."

An ingenious form of speed-recording apparatus has been recently devised for use in some German railway experiments. While simple in design, it proved exceedingly effective, and showed, moreover, not only the speed at any particular moment, but the time in which stops were made, speed round curves, up grades etc. Electrical connections were made on the axle of the carriage in such a manner that a dash and a space were marked off at each revolution on a paper strip moved by clockwork. By marking the length of the ribbon corresponding to one minute of time and counting the number of dashes contained therein, the number of revolutions is given at once, and from the diameter of the wheels the speed can readily be computed.

RECENT COMPANY ELECTIONS.

Concord Street Railway Company, Concord, N. H.—Directors: John H. Albin, George A. Cummings, Howard A. Dodge, Paul R. Holden, George W. Abbott, Gardner B. Emmons, Hiram A. Tuttle.

Cortland & Homer Traction Company, Cortland, N. Y.—President, P. S. Page of Scranton; vice-president, Herman Bergholz of Ithaca; secretary and treasurer, G. Harry Garrison of Cortland.

Derby Street Railway Company, Derby, Conn.—President, H. Holton Wood, vice-president and treasurer, Chas. F. Clark; secretary, F. W. Wallace; assistant treasurer, B. W. Porter.

Nyack Traction Company, Nyack, N. Y. (new organization).—President, H. O. Howard, Chester, Pa.; treasurer, E. F. Walker, Philadelphia; secretary, G. D. Howell, Chester, Pa.

COMMERCIAL PARAGRAPHS.

We would call our readers' attention to the direct-reading Voltmeters and Ammeters manufactured by the Cherry Electric Works, 25 and 27 Third avenue, New York City. This well-known concern has made a specialty of low-priced electrical measuring instruments which may be advantageously used where high-priced instruments would be out of the question. These instruments, which are by no means toys, can be depended on for practical work, each being individually calibrated and guaranteed to be commercially accurate and, with proper care, to give good and accurate results. The price of these instruments is but $1.50 each, although the Cherry Electric Works are prepared to furnish a somewhat better grade of measuring instruments for five, ten and fifteen dollars. Ammeters and voltmeters of the above description would seem admirably adapted for experimental work where a high-priced instrument could ill be afforded.

The recent fluctuations in the prices of sockets, receptacles, cut-outs, insulators, etc., have made it somewhat difficult for the ordinary buyer to keep track of the market prices on these goods. The Electric Appliance Company, Chicago, have just issued a special price list of all of this material, giving trade prices that are strictly up to date. It is in the form of a small circular, which should be of

considerable value to the purchaser of staple electrical supplies.

Prosecution of Ticket-Scalpers.

Cincinnati, Sept. 7.—The people of Cincinnati have thrown a firebrand into the camp of the railroad ticket-scalpers. A short time ago the common council of Cincinnati passed an ordinance regulating the ticket-scalpers within the city limits. It provided that each scalper should be licensed and give bonds against the selling of spurious, counterfeit or stolen tickets. This morning eight ticket scalpers were fined in the police court and there are six others in jail. Judge Harmon, Attorney-General of the United States in President Cleveland's Cabinet, and other prominent lawyers appeared in the police court against the scalpers and secured their conviction. The interest taken in prosecuting those engaged in this illegitimate business is remarkable, but the people of Cincinnati have apparently determined to root out the evil from their city.—*From New York Tribune, Sept. 8, 1898.*

We are in receipt of a handsomely gotten up catalogue containing 186 pages and issued by the Western Telephone Construction Company, 250-254 South Clinton street, Chicago. It is profusely and handsomely illustrated, showing switchboards, telephone transmitters and receivers and views of the various departments of this company. Several of the closing pages are devoted to testimonials in the form of letters received from numerous independent telephone companies throughout the country which simply go to prove, what has already been known for some time, that this concern turns out a high grade and excellent quality of apparatus.

The Crane Company of Chicago has just issued a complete pocket catalogue of 428 pages showing its entire line. The catalogue contains dimension tables of screwed and flanged fittings and valves, and also a number of pages of useful information to mechanical engineers. We are authorized to state that a copy will be sent to anyone upon request.

INCORPORATIONS.

The Ironclad Resistance Company, Westfield, N. J.—to carry on an electrical business for the purpose of supplying light, heat and motive power. Capital stock, $25,000. Incorporators: Arthur W. Berresford, August P. Manning and Horace M. Williams.

The Storage Battery Supply Company, New York. Capital stock, $12,000. Incorporators: T. D. Bunce, F. E. Foster and W. E. Foster.

The F. L. Merrill Company, Portland, Me.—to deal in hardware and electrical supplies. Capital stock, $100,000. Incorporators: George O. Owen and Fritz H. Jordan, Portland.

The Mill Point Power Company, Amsterdam, N. Y.—to furnish light, heat and power to the city of Amsterdam and the towns of Charlestown, Florida, Amsterdam, Glen and Mohawk, and the villages of Fonda and Fultonville, and the towns of Johnstown, Perth, Mayfield and Broadalbin. Capital stock, $80,000. Directors: John Marsh of San Francisco, John Begley of Gloversville, H. J. Brady of Cooperstown, P. T. Brady and R. E. Drake of Syracuse.

The Kansas City Interurban Railway Company, Kansas City, Mo.—to maintain an electric railway in Kansas City. The company has purchased the Waldo Park dummy line and will convert it into an electric road, extending it so as to connect with the Mellier place line. Capital stock, $300,000. Incorporators: Henry Pfeiffer of Westport; H. G. Park, B. H. Chapman, C. H. Mathews and C. H. Chapin of Kansas City.

The Chicago Suburban Water & Light Company, Chicago, Ill.—to deal in water, gas and electricity. Incorporators: Charles F. Vogel, J. M. Gibson and Charles B. Wood.

The Hevner Road Bed Company, Camden, N. J.—to equip trolley and other railroads. Capital stock, $250,000, of which $20,000 has been paid in.

ELECTRICAL PATENT RECORD.

Letters Patent Issued September 13, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

610,620. Commutator-Brush Holder. William K. Bassford, Jr., Bound Brook, N. J. Filed Feb. 1, 1898.

610,705. Brush for Electrical Machines. Joseph W. Dickey, New York City, assignor of one-half to Charles E. Chapin, same place and Milford, Conn. Filed Dec. 8, 1894.

610,712. Apparatus for Starting and Controlling Electric Motors. Theodore W. Kloman, New York City. Filed April 4, 1898.

TELEPHONE AND TELEGRAPH APPARATUS.

610,701. Telephone System. William W. Dean, St. Louis, Mo., assignor to the Bell Telephone Company of Missouri, same place. Filed Sept. 3, 1897.

MISCELLANEOUS.

610,524. Electrically-Controlled Valve for Hydraulic Presses. William B. Cleveland, Cleveland, O. Filed Jan. 21, 1898.

610,539. Electric Clock. Frank Hope-Jones and George B. Bowell, London, England. Filed Dec. 18, 1897.

610,726. Art of Bending Armored Conduit-Tubes. William T. Ruete, New York City, assignor to the Interior Conduit & Insulation Company, same place. Filed Nov. 24, 1897.

610,767. Magnetic Separator. Ambrose Monell, Munhall, Pa. Filed Jan. 10, 1898.

TELEPHONE AND TELEGRAPH.

The Western Electric Company of Chicago has filed suit in the United States Circuit Court at St. Louis for an injunction against the Kinloch Telephone Company and Samuel M. Kennard, president of the company, enjoining them from using and making a certain multiple switchboard for telephone exchanges. The plaintiffs state that Leroy B. Firman, patentee, sold them the exclusive right to the invention January 7, 1881, and that they have been manufacturing the switchboards. H. J. Hanford, manager of the Kinloch Telephone Company, when questioned about the case, said that the suit was identical with the suit of the Western Company, which is controlled by the Bell Telephone Company, and was identical with the suit recently decided at Chicago by Judge Showalter in favor of the Kellogg Company, under whose patents the Kinloch is to operate. "I believe the application was filed for a bluff," said Mr. Hanford. "They only want to harass us in our work. Why, the court doesn't meet here till November and they file the application in September, just as the Kinloch is getting ready to open for business. The case is filed, too, in a court of no higher jurisdiction than Judge Showalter's. However, the Kinloch will go right on finishing up its circuits and getting in shape to open up. We have now more telephones in this city than the Bell, and orders are coming in daily."

French advices state that experiments are being conducted on the Paris-Bordeaux line with a telegraph invention of M. Mercadier, which he has been working on for many years, and which, it is claimed, enables the working of twelve Morse transmitters simultaneously on the same line. This result is brought about by the use of alternating or interrupted currents. Each transmitter receives its current through a tuning fork, having a special note, its vibrations being electrically maintained. These vibrations furnish a current of the proper period to cause the resonance at each application in the proper receiving circuit, which has its self-induction and capacity adjusted for this result. This receiver is a telephone (a monotelephone, as it is called by M. Mercadier), so constructed and arranged that the acoustic resonance qualities also help to damp out from the signals received everything not intended for it. These signals are read in the ordinary way, by ear, aided by rubber tubes, like those used on phonographs. The sifting out of the signals, it seems, is very perfect, each receiver giving no evidence of those signals not intended for it, except a slight murmuring, very indefinite and not at all bothersome. The instruments are called duodecaplex.

Telephone and telegraph companies in Michigan pay taxes to the State on the basis of their valuation instead of in the form of specific taxes, as in the case of railroads, express companies, etc. The law provides that such companies shall pay taxes at the same rate that other property in the State is assessed. For this year the telegraph companies were assessed $18,499.93, of which sum the Western Union Telegraph Company paid $15,711.40. The telephone companies paid $41,086.78 in taxes, the appraised valuation being $1,369,560. The Michigan Bell Telephone Company paid $26,348.32, the Detroit Company $6,460.02, the Citizens' Company of Grand Rapids, $2,586.83, and the American Telephone & Telegraph Company $1,630.37. There are now thirty-one telephone companies in the State where there was but one ten years ago.

The Worcester, Mass., *Post* says there is another telephone company proposed as a rival of the New England Telephone & Telegraph Company in that city. It is projected by F. Plummer of Plummer, Ham & Richardson, and has no connection whatever with the People's Telephone Company, which I. L. Currier and Alderman James H. Mellen are talking of organizing. Mr. Plummer says that a meeting will be called in the interests of his company shortly and if business men subscribe for stock it will be incorporated.

The Commercial Cable Company, it is reported, has perfected arrangements to lay a direct cable from New York to Ponta Delgarda, on St. Michaels, the most eastern island of the Azores group, which is connected already with the other islands by submarine cable. At present there is no direct telegraphic communication with the Azores from the United States, messages being forwarded by way of London, and the cable facilities are so poor between that city and the islands that there is much delay in the transmission of messages.

The Mississippi Valley Telephone Company has made an arrangement with the Dakota Central Telephone Company by which the former company, now being located in St. Paul and Minneapolis, will have connection with 1,000 miles of wire, a portion of which reaches Nebraska towns.

The city of Richmond, Va., intends to continue its fight with the Southern Bell Company, which, in the language of the Richmond *Times*, "is now doing business in Richmond by grace of an injunction granted by Judge Nathan Goff, of the United States Circuit Court." The Board of Aldermen on the 13th inst. suspended its rules and adopted unanimously a resolution providing for the employment of assistant counsel to the city attorney in the conduct of the case, which is now pending in the Supreme Court of the United States.

The city council of Helena, Ark., has passed an ordinance regulating the rates to be charged for telephones in that city. The rates fixed in the ordinance are $1.50 for residences and $2 for business houses. The present rates are $3 and $4 respectively. The Southwestern Telephone & Telegraph Company, through its attorneys, fought the reduction bitterly and say they are going into the courts and will test the right of the city to regulate its rates.

The movement for independent telephone toll lines in northern Indiana is taking shape and contracts have already been let for several hundred miles of toll lines. With the building of first class independent toll lines, the independent local exchanges, which have been at a disadvantage because they lacked outside connections, will grow much more rapidly, and in cities where there are no independent exchanges, new companies will spring into existence.

Among the passengers on the steamship Empress of India, which sailed from Vancouver last week for Hong Kong and Yokohama, was James F. Scrymser, president of the Pacific Cable Company of New York, who is going to Japan to try to obtain a subsidy for the cable company. He says capital has been guaranteed for the cable from San Francisco to Australia.

English capitalists have secured a controlling interest in the New Westminster, B. C., and Burrard Inlet Telephone Company. The ramifications of this company extend over a vast area. The transaction is important, not only because of the individual sale itself, but as showing that British capitalists are again turning their attention to Vancouver and surrounding districts as a field for profitable investment of money.

The Bell Telephone Company has purchased the Greenville, Texas, Independent Telephone Exchange. The exchange was built by Mr. Hawley and equipped with Western Telephone Construction Company's apparatus. It worked so successfully that the monopoly was forced to buy it or abandon that field.

C. T. McCreary, the superintendent of the new People's Telephone Company at New Orleans, has assumed charge of the work of putting up the telephones in that city. All the wires in the business portion of the city will be laid underground.

The Citizens' Telephone Company of Magnolia, Miss. has been granted a franchise to maintain a local and long distance telephone system in Magnolia. The company has been incorporated.

A franchise to establish a telephone exchange in Washington, Ga., has been granted to the firm of Neal & Grier of that city. They agree to connect their system with the Elberton telephone exchange at Elberton.

A telephone line will be constructed at once from Elizabeth via the Little Kanawha Railroad to Parkersburg W. Va.

The local telephone exchange at Cuero, Tex., has been sold to the Southwestern Telephone Company.

Under the new tariff of Japan, the duty on telephones and parts thereof is 10 per cent. advalorem.

New Companies Incorporated.

The Havana Telephone Company, Havana, Ill. Capital stock, $5,000.

The Bryan Telephone Company, Bryan, O.—to build and operate a telephone line between Bryan and Waseon. Capital stock, $20,000.

The Cuyahoga Telephone Company, Cleveland, O.—to construct telephone lines in Ohio and operate them as competitors of the Bell Company. Capital stock, $3,000,000. Incorporators: J. B. Hanna, J. B. Hodge, H. Clark Ford, H. A. Everett, E. W. Moore and W. B. McGraw.

The North Park Telephone Company has been incorporated at Cheyenne, Wyo., its purpose being to operate telephone line between Walden, Col., and Laramie, Wyo Capital stock, $15,000. Incorporators: Monte Blevins, J. Mosman, G. F. Scott, O. E. Mosman, M. A. Ward.

The American Electric Telephone Company, Chicago, has certified to an increase of capital stock from $100,000 to $130,000.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Sept 19:						
Albany Ry. Co	100	2,000,000	$1,750,000	1¼ % Q., Feb. '98.	153	155
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97	50	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Sept 19:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Sept 19:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	89	..
Baltimore, Md.—Sept 19:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '97.	71	72
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23⅜	23¼
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—Sept 19:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	...	..
North Shore Traction Co....com.	100	4,000,000	4,000,000	....	10½	12
North Shore Traction Co....pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	78½	80
b West End Street Ry. Co....com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	85¼	85¾
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	105	106
Boston Elevated R. R	100	10,000,000			69½	70½
Brooklyn N. Y.—Sept 19:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	59	59¼
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR....guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	214½	216
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	223	240
Kings County Elevated	....	4,750,000	4,750,000	....	6	7
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	..	40
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Sept 19:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	67	68
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	79	81
Columbus O.—Sept 19						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Feb., '98.	51½	52½
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Sept 19:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Sept 19.						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	275	288
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12¼	13
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Jan., 98.	222	224
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	94	94½
jChicago West Div. Ry....guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry....guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Sept 19:						
Cincinnati Inc. Plane Ry....com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry....pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1½ % Q., Jan., '98.	118	118¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1½ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Sept 19:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	38	40
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '97.	69	72
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	74	77
Detroit, Mich.—Sept 19.						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '98.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Sept 19:						
City Railway Co....com.	100	1,500,000	1,470,600	1½ % Q., Jan.1,'98.	104	105
City Railway Co....pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	103

*Unlisted. † Ex div.
a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
b Leased to Boston Elevated Railroad Company.
c Owned by Brooklyn Rapid Transit Company.
d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.
e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR
g Owned by Atlantic Ave. RR. and leased to Nassau system.
h $60 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $290,100 of stock owned by North Chicago Street Railroad Company.
i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.
k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Sept 19.						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan.. '98	140	–
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	–
Holyoke Mass.—Sept 19.						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—Sept 19:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	–
Indianapolis, Ind—Sept 19.						
**Citizens' Passenger Ry	....	5,000,000	5,000,000	....	25	26
Lancaster, Pa.—Sept 19:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	..
Lancaster & Col. Electric Ry	....	....	87,500	....	..	..
West End Street Railway	...		......		..	..
Louisville, Ky.—Sept 19:						
Louisville Ry....com.	100	4,000,000	3,500,000	1½ %., Oct., '97.	84	89
Louisville Ry....5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	96	100
Minneapolis, Minn.—Sept 19:						
Twin City Rapid Transit....com.	100	17,000,000	15,010,000	....	25	..
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,714,200	1¾ %. Jan., '98.	101	103
Montreal, Canada.—Sept 19:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	277½	278
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	101¼	101½
Memphis, Tenn.—Sept 19:						
Memphis Street Railway Co	100	500,000	500,000	....	15	–
New Haven, Conn.—Sept 19:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	..
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '98.	60	80
New Haven & Centerville	100	700,000	300,000		..	..
Winchester Avenue RR	25	1,000,000	600,000		40	42
New Orleans, La.—Sept 19:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	150	180
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	124
New Orleans Traction Co....com.	100	5,000,000	5,000,000	....	1	2
New Orleans Traction Co....pfd.	100	2,500,000	2,500,000	....	5	8
aCrescent City RR....guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	28½
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	..
Orleans Railroad	50	500,000	185,000	1½ %, June, '94.	22	26
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	52½	55
New York—Sept 19						
Central Crosstown RR	100	600,000	600,000	2½ % Q., July, '97.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., Jan., '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98	150	155
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1½ % Q., Jan., 98	155¼	156
eBleecker St. & Fulton Fy.Ry.guar	100	900,000	900,000	¾ % A., July, '97.	34½	37
fBroadway & Seventh Ave....guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	216	220
gCen.Park, N.&E. Rivers RR. guar	100	1,800,000	1,800,000	2½ % Q., Jan, '98	180	185
hEighth Avenue RR	100	1,000,000	1,000,000	....	350	..
i42d St. & Grand St. Ferry RR.guar	100	750,000	748,000	4½ % Q., Feb., '98.	360	...
jNinth Avenue RR....guar.	100	800,000	800,000	......	118	190
kSixth Avenue RR....guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q. Feb., '98.	310	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., Jan., '98.	178	180
Third Avenue RR	100	12,000,000	10,000,000	2 % Q., Feb., '98.	178	177
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	65	70
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Sept 19.						
Consolidated Traction Co. of N. J...	100	15,000,000	15,000,000	....	50½	52
Newark Passenger Ry	100	6,000,000	6,000,000	....		
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Sept 19:						
Allegheny Traction Co	50	500,000	500,000	....	..	50
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	21⅝	..
Consolidated Traction Co....pfd.	50	15,000,000	15,000,000	3 %, May, '97.	55¾	[illegible]
pCentral Traction Co	50	1,500,000	900,000		...	..
qCitizens' Traction Co	50	3,000,000	3,000,000	6 % A.	...	..
rDuquesne Traction Co	50	3,000,000	3,000,000	6 % A.	..	..
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	...	..
Federal St. & Pleasant Valley Ry..	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	25
Pgh., Allegheny & Man. Trac. Co...	50	3,000,000	2,994,339	2 %, Aug., '95.	...	..
Pittsburg & Birmingham Trac. Ry.	50	3,000,000	3,000,000	1½ %, Jan., '98.	28⅛	21¾
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 97.	..	..
Second Avenue Traction Co....com.	50	4,000,000	14,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	300,000	....	..	..

*Unlisted. ‡ Full paid. | Outstanding. † Ex div.
a Leased to New Orleans Traction Company at 6 % on stock.
b Leased to New Orleans Traction Company at 8 % on stock.
c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.
d Operating the former Met. Trac. system, that corporation having become extinct.
e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
g Leased to Metropolitan Street Railway at 3 % on stock until Oct. 1, 1897; thereafter 9 %
h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.
i Leased to Metropolitan Street Railway for 18 % on stock.
j Leased to Met. St. Ry. for 99 years from April 20, 1893; 6 % first 5 years, 8 % thereafter
k Leased to Metropolitan Street Railway for $145,000 per annum.
l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
m Controlled by Third Avenue Railroad by purchase.
n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.
o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co.
p Leased to Consolidated Traction Company for 8 % per annum on par value of stock
q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.
r Leased to Consolidated Traction Company for 4 % on capital stock after October.
s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Sept 19						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass—Sept 19						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Sept 19:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Sept 19:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Sept 19						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	70	72
Philadelphia.—Sept 19:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	ǀ1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	583,900	‡533,900	3 % S—July, '98.	67½	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	65½	66
Union Traction Co........... $12½ pd	50	30,000,000	29,930,450	....	19¾	19⅞
bElectric Traction Co	50	....	8,297,920	....	71⅜	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	ǀ1,875,000	$14 sha'e A—Apr.98	392	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	268	...
bPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '93.	...	..
gGermantown Passenger Ry	50	1,500,000	ǀ572,800	$5.25 share—1898.	185	186
gGreen & Coates Passenger Ry.	50	500,000	ǀ150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	ǀ740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	ǀ277,402	....	...	...
bPhiladelphia Traction Co	50	30,000,000	ǀ20,000,000	4 % S—Oct. 1, '97.	92⅞	93
iCatherine & Bainbridge St	50	....	ǀ400,000	6 % A—Mar., '98.	...	..
iContinental Pass. Ry.....guar.	50	1,000,000	ǀ580,000	$6 share—July, '98.	136¼	..
Empire Passenger Ry. Co	50	600,000	ǀ600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	ǀ475,000	$7.50 share July '98	175	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	88	..
jRidge Avenue Passenger Ry	50	750,000	ǀ420,000	$12 share, July '98.	288	300
jPhiladelphia & Darby Ry.guar.	50	....	ǀ200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	ǀ250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	ǀ835,000	$11 sh. A., July, '98	275	...
jUnion Passenger Ry. Co	50	1,500,000	ǀ900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	ǀ750,000	$10 share, July '98	225	230
Rochester, N. Y.—Sept 19:						
Rochester Railway Co	100	5,000,000	5,000,000	....	12	15
Reading, Pa.—Sept 19:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	20
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Sept 19:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1½ % July, '98.	129	131
National Railway Co	..	2,500,000	2,479,000	1½ %, July, '98.	..	—
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000		..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '93.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry...........com.	50	500,000	500,000		57½	59½
Southern Electric Ry.......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	113	115
St. Louis & Suburban Ry	100	2,500,000	2,500,000		53	55
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Sept.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	106	107¾
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53¾	54¼
Presidio & Ferries RR	100	1,000,000	550,000	....	8½	8⅝
Scranton, Pa—Sept 19:						
Scranton Railway Co	50	6,000,000	2,500,000		12	15
m Scranton & Carbondale Trac. Co.	100	500,000	500,000		14	18
m Scranton & Pittston Traction Co	100	1,050,000	1,050,000		..	..
Springfield Ill.—Sept 19:						
Springfield Consolidated Ry	100	750,000	750,000	....	—	11
Springfield O.—Sept 19:						
Springfield Street Ry	100	1,000,000	1,000,000		..	2
Springfield, Mass.—Sept 19:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—Sept 19:						
Toronto Ry. Co.	100	6,000,000	6,000,000	1¾ % S.	104¼	104½
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.	277½	278
Washington, D. C.—Sept 19:						
Belt Ry. Co.	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh. Oct. 97.	74¼	75
Columbia Ry. Co	50	400,000	400,000	6 % A.	..	75
Eckington & Soldiers' Home Ry	50	707,000	652,000		8	..
Georgetown & Tenallytown Ry	50	200,000	200,000		..	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	125	125½
Worcester, Mass.—Sept 19:						
*Worcester Traction Co.........com.	100	8,000,000	8,000,000	....	16	18
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	93	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Sept 19:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ǀ Outstanding. ‖ Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
f Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Sept 19:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., July, '98.	279	281
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	73	74
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Feb. '98.	140	..
New York.—Sept 19:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	96	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	109	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	170	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	44
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan.., '98.	73	74
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	118
*International Ocean Tel Co.guar 6%	100	8,000,000	......	1½ % Q.	109	112
Mexican Telephone Co	100	2,000,000	......		..	.65
*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1½ % Q., Jan., '98.	149½	150½
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	93⅜	93½
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Sept 19:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	168½	178½
Chesapeake & Potomac Telep. Co.	100	......	......	....	48	55
Chicago Telephone Co	100	......	......	......	212	..
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	132½	134
Empire & Bay States Telegraph Co.	...	......	......	....	72	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	76	77
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	112	115
Providence (R. I.) Teleph. Co.	50	....	......	....	86	90
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Sept 19:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
General Electric Co.............com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	46½	47
General Electric Co.............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	...	99¾
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	80	81
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., July, '98.	57	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Sept 19:						
Edison Elec. Ill'g Co., New York.	100	9,138,000	7,988,000	....	181	184
*Edison Elec. Ill'g Co., Brooklyn.	100	4,000,000	4,000,000	1½ % Oct., '97.	119	120
Edison Ore Milling Co	100	....	......	....	11	14
Edison Electric Storage Co	..	....	......	....	21	23
General Electric Co...........com.	100	40,000,000	30,460,000	2 % Q., Aug , 1898.	46½	47
General Electric Co............pfd.	100	10,000,000	4,252,000	3½ % S., July, '98.	...	99¾
Interior Conduit & Insulation Co.	100	1,000,000	1,000,000	....	41	..
United Elec. Lt. & Pow. Co.....pfd	..	......	......	....	..	..
Pittsburg, Pa.—Sept 19:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	180	140
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Sept 19:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	86¼	87
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	42	42½
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$82500 dis. Jan. 11 '97	13½	14
Southern Elec. Light & Power Co.	10	187,500	187,500	....	8	10
Miscellaneous.—Sept 19:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co.	25	500,000	......	......	82½	85
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	15
Eddy Electric Mfg. Co	25	......	......	....	—	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	120	..
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	4½	10
New Haven (Conn.) Elec. Lt. Co.	100	100,000	......	....	175	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	83½	87
Rhode Island Elec. Protec. Co	100	......	......	....	118	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q	*160	161
Toronto (Canada) Elec. Light Co.	100	1,085,000	1,085,000	1¾ % Q	137⅞	138⅛
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	.....	......	....	100	110

*ex d

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Sept 19:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb. 1, '98	85	87
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—Sept 19:						
Consolidated Electric Storage Co.	...	......	....	....	18	20
Edison European	..	......	....	....	1	3
Safety Car Heating & Lighting Co.	100	......	....	......	102	105
Worthington Pump Co.........com.	100	5,500,000	5,500,000	......	24	28
Worthington Pump Co...........pfd	100	2,000,000	2,000,000	7 %	90	93
Philadelphia, Pa.—Sept 19:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1½	1½
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	18¼	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	71	73
Welsbach Light Co	5	525,100	......	....	51	51½
Welsbach Light Co., Canada.	5	500,000	......	....	..	2¼
Pittsburg, Pa.—Sept 19:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co.	100	1,000,000	1,000,000	Q	115	120
Miscellaneous.—Sept 19:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	10	12½
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	...	60
Billings & Spencer Co	25	......	....	....	80	87
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	82½	87½
Johns-Pratt Co	100	......	....	....	98	100
*Pratt & Whitney Co..........com.	100	......	....	....	4	8
*Pratt & Whitney Co...........pfd	100	......	....	....	..	48
Stillwell-Bierce Co............com.	..	......	....	....	70	80
Stillwell-Bierce Co............pfd.	..	......	....	2 % Sept. 1, '97.	..	..
Shultz Belting Co	100	500,000	....	....	60	80
St. Charles Car Co	—	....	....	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Sept 19, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR.1st mtg. 6s	850,000	850,000	1919	M. & N.	*118½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..................1st 5s	....	....	......	......	*105	105½

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Sept 19, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	......
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	......
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	105¼	105¾
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	102½	104
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co.........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	117	118
City & Suburban Ry......1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	115	115½
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	114¾	121
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st.mtg.bds.

Boston, Mass.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	104¾
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M.& N.	105	106
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	... .	....
†Charleston City Ry...........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry .Co.

Chicago Ill.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¼	102⅝
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	104¼	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	53¾	54
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	106½	107
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	100¾
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	95½
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Sept 19, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov.St. Ry.1st Con.mtg. g.5s	3,000,000	2,500,000	1922	J. & J.	103¾	104
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc.Cons.mtg.5s	531,000	531,000	1906	M. & S.	107¼	108
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	103¾	104
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry.Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103½	105
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
aEast Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	103	104¾
Ft. Wayne (Ind.) Elec. Ry.1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	106	......
New Haven (Edgewood Div.)1st mtg.5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben, g. 6	100,000	94,000	1909	M. & S.	103	......

*With interest. *Unlisted.

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR..............1st mtg. 6s.	....	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	76⅛	79
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	107	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	103⅛	104¼
N. Orleans & Carrollton RR.2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	105	110
‡St. Charles St. RR. Co......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	......	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn).1st gen. mtg.5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	108	......
‡Bro'dway & 7th Ave.1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	120⅝	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	106	110
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111⅛	114
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	106	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	......	......
¶Brooklyn, Bath & W.E. RR.Gen.mtg.5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	108	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	105½	......
Bleecker St.& Fult'n Fer'y RR.1st mtg.7s	700,000	700,000	1900	......	102	105
Cent P'k, N. & E. R. RR.1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	112	......
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	......
Coney Island & Brooklyn RR.1st mtg.5s	300,000	300,000	1903	J. & J.	103½	104
§D. Dock, E. Bd'y & Bat'y R.gen.mtg.g.5s	1,000,000	930,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100½	*102½
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	118	116
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	98	99
Lex. Ave. & Pav. Ferry RR.1st mtg. g.5s.	5,000,000	5,000,000	1993	M. & S.	119	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	113⅛	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600 000	1909	M. & N.	108	110
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115⅛
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124	125
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	112	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111⅛	112⅛

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Sept 19, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	....	....	....
People's Pass. Ry...................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	....	1943	....	102	103
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co................Col. tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s.	....	....	1905	....	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	92	95
Central Traction Co................1st mtg. 5s.	875,000	875,000	1930	J. &. J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	117½
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108½	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	106	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	105¼	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co......................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	108	109

St. Louis.

Date of Quotation—Sept 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	100½	101½
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	101½	102½
Citizens' Railway Co............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1913	J. & J.	111	112½

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Sept 19, 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	250,000	250,000	1908	J. & J.	80	85
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co....................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	107	108
†Mound City RR. Co.............1st mtg. 6s.	400,000	300,000	1910	A. & O.	101	103
People's RR. Co...................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co...............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co...................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry...............Income 5s.	300,000	300,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	110½	111½
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	114	115

†Controlled by St. Louis RR. Co.
‡Controlled by Union Depot RR. Co.
¶Controlled by Lindell RR. Co.
‖$200,000 in escrow to retire 1st & 2d mtg.
§$600,000 in escrow.
††$200,000 in escrow to retire 1st mtg. bds.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
San Francisco Cal.						
Date of Quotation—Sept, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	113½	115
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	115½	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	93	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	126½	....
†Metropolitan Ry. Co...............1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127¼	128
†Park & Cliff House RR.........1st mtg. 6s.	350,000	350,000	1912	J. & J.	104½	105½
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	107	......
†Powell St. Ry......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118	120
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......

†Controlled by Market St. Ry. Co.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Washington D. C.						
Date of Quotation—Sept 19, 1898.						
Belt Ry. Co.........................C[illegible] mtg 5s.	500,000	450,000	1920	J. & J.	......	....
Columbia Ry.................................. mtg. 6s.	500,000	500,000	1914	A. & O.	120	125
Eckington & Soldiers' Home mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	121¾	......

†$50,000 in escrow to retire 1st mtg. bds.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Sept 19. 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	112	114
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	110½	111½
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	100½	101½
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	10[illegible]¾	109
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	102
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	86
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	115	11[illegible]¾
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	92	94
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	3,000,000	2,378,000	1928	J. & J.	103	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	98	100
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	93½

†$1,000,000 in escrow to retire 1st and 2d mtg. bds.
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.
‖$87,000 in treasury.
§$960,000 res'ved to redeem prior liens.
††$620,000 in escrow.

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Sept 19, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	103¾	....
Pittsburg, Pa.						
Date of Quotation—Sept 19, 1898						
Allegheny County Light Co................6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Sept 19, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	110	. ..
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1998	......	117½	......
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1928	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Sept 19. 1898.						
American Bell Telephone.......................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co..................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Sept 19, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co......................	....	....	......	......	......	25
Barney & Smith Car Co......................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co ....5s.	....	....	1904	M. & S.	....	....
Worthington Pump Co................................	[illegible]	......	....	......	....	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12@12⅛c.; Lake, 12¼@12⅜c.; casting, 11⅞@12c.

The Edison Electric Illuminating Company of Brooklyn has declared its regular quarterly dividend of 1½ per cent., payable to stock of record September 30.

The Cincinnati & Hamilton Electric Railway Company has placed on file in the recorder's office at Cincinnati a mortgage for $500,000 in favor of the American Trust Company.

Secretary Ely of the New York Stock Exchange has issued a notice that the old stock of the General Electric Company will be traded in in the unlisted department and will be quoted on the tape as "G. E., old."

The Boston Elevated Railway Company has declared to the common stockholders of the West End Street Railway a semi-annual rental dividend of 3½ per cent., payable to stock of record September 17. Books will reopen October 2.

The earnings of the Montreal Street Railway for the eleven months ending September 1 amounted to $1,323,085, an increase over the corresponding period of last year of $110,289. August was a big month and the earnings amounted to $143,801.

The American Automobile Company, with a capital stock of $500,000, filed articles of incorporation in the county clerk's office, Elizabeth, N. J., on the 17th inst. The chief office of the company will be in Plainfield, N. J. It will engage in the manufacture of motors and other appliances.

A circular has been issued by the directors of the Royal Electric Company of Montreal calling a special meeting of the shareholders on October 18 for the purpose of authorizing an issue of preferred stock, and the acquisition of shares in the Chambly Manufacturing Company for an additional amount of $100,000.

The Western Union Telegraph Company's annual meeting will be held October 12. The regular quarterly dividend of 1¼ per cent. on the stock has been declared, payable October 15, books closing September 20 and reopening October 17. The estimated earnings for the quarter were $1,750,000; actual $1,677,202.

The first mortgage bondholders' committee of the Terre Haute (Ind.) Street Railway Company gives notice that, more than 87 per cent. of the bonds having been deposited, the limit of time for receiving further deposits is extended to October 1, after which date bonds will only be received subject to such penalty as the committee may impose.

The Cleveland "Press" says "there is a general feeling among local brokers that the controversy over the Big Consolidated is ended. There is no market for the stock. The leaders of the two factions say there is nothing more that can be done. Each side is positive it controls enough stock to carry the election in January, and all that can be done is to wait. While each side tells this story and claims it has a controlling interest in the company, it is not taking any chances. Although neither side is buying any stock, both are getting options wherever they can."

A dispatch in the N. Y. "Journal" dated, Chicago, September 19, contains the following: "The Leiters—Levi Z. and Joseph—made a new move to-day in the direction of their contemplated control of the Chicago street railway system. The Chicago City Railway Company, of which Levi Z. is one of the largest individual owners and Joseph one of the recently elected vice-presidents, has undoubtedly secured control of the 'Alley L' road, one of the effects of the deal being to send up the stock of the latter company almost four points on the local Stock Exchange."

An advertisement in the Wheeling, W. Va., "Intelligencer" announces that the annual meeting of the American Railway Electric Light Company will be held at the office of the company, No. 14 Stone street, New York, on the 4th of October at noon, at which an election will be held of directors and a resolution will be offered increasing the number of shares of stock of the company from 50,000 to 60,000 shares of the par value of $50 each, thus increasing the capital stock of the company from $2,500,000 to $3,000,000. Transfer books will close September 23 and reopen on October 5.

The amalgamation of the Walker Company of Cleveland with the Westinghouse Electric & Manufacturing Company, which was announced officially on the 17th inst., had been meditated for some time and was no great surprise to any one in the electrical business. The two companies have suffered greatly from litigation, and their misfortunes have probably tended to bring about the union which has been accomplished, their common antagonist, the General Electric, having apparently consented to, if it did not encourage the match. This concord of warring interests will be reflectively studied by all engaged in the electrical trade.

The Brooklyn "Eagle" treats as a fact the announcement that a large block of stock of the Nassau Railroad Company has been sold by R. T. Wilson to ex-Gov. R. P. Flower and other representatives of the Rapid Transit Company. It intimates that the opposition of the Johnsons, who are deeply interested in Nassau securities, to the lease is purely a matter of money and will be maintained unless they are paid par for their stock. In the case of P. H. Flynn, another heavy holder of Nassau stock, it says his opposition "is more personal and therefore on more lasting grounds, and there is every reason to believe that he will fight any plan leading to a Flower control of the road, which was authorized and constructed largely through his efforts and as a competitor and rival of the Transit Company's, without a fight that is likely to rival the Long Island Traction contest in bitterness and longevity."

T. L. Livermore and Edwin F. Atkins, the committee of preferred stockholders of the General Electric Company, have issued the following circular to depositors of preferred stock under agreement of June 1 with the American Loan & Trust Company: "Your committee have been in negotiation throughout the pendency of the litigation with the General Electric Company, but have been unable to adjust the controversy with the company to their satisfaction. They have now received from individuals a proposition which they have decided to recommend you to accept. It is that we sell our shares and rights in respect thereof at $100 a share cash, on or before October 1, 1898, with interest from July 1, 1898, at 6 per cent. This is not as favorable a result as we have hoped for. It amounts to five years' back dividends and $65 per share for the unreduced stock. In view, however, of the doubtful character of the questions raised, the protracted and expensive litigation involved and the comparatively small number of shareholders, say one-fourth of the preferred stock, taking part in it, we have accepted the offer for ourselves and recommend it to you. The price above named will be paid without any deduction for the expenses of the proceedings to date. Those who elect not to accept this offer either may acquiesce in the reduction of their shares pursuant to the recent action of the company and accept new stock certificates for the reduced amount of stock, or at their election take up and pursue the pending litigation at their own risk and expense. We have instructed the American Loan & Trust Company to dismiss the pending suit, unless, prior to October 1, 1898, some depositor shall take suitable action to continue the litigation as above stated. We have already given instructions to dismiss the suit forthwith as to all the complainants except the American Loan & Trust Company. The 10,000 shares of stock on deposit with the trust company were sold to the syndicate on a basis of $100 per share and interest from July 1 at the rate of 6 per cent. cash."

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CONTENTS.

EDITORIAL NOTES.

The American Indies Company.

In a recent editorial we pointed out what excellent fields both Cuba and Porto Rico offered for electrical enterprises. Since then a company to be known as the American Indies Company has been organized for the purpose of developing the resources of these two islands. It is capitalized at $18,000,000 and incorporated under the laws of New Jersey. According to the prospectus recently given out, the new enterprise is to cover every important field, and should it prove successful will almost monopolize the electrical industry in those islands. Under its charter the company has the right to generate, accumulate, distribute and supply electricity for light, heat, power and signaling purposes; to construct, own and operate plants for the conveyance of electrical current for telegraph, telephone and various other purposes; to construct and operate telephone exchanges; to manufacture and supply gas for fuel and illuminating purposes, and to light cities and buildings. It has the right to acquire real estate of almost every description and to mine, smelt and refine. Its charter further empowers the company to own, build and operate sewers, water works and all other public and private improvements, as well as to own and operate steamships or other vessels. The secretary of the company, Mr. Henry D. Macdona, in a recent issue of the New York *Herald*, is credited with the following statement:

"The company has been in process of formation for several months and was organized for the purpose of taking advantage of the extraordinary economic transformation now at work in Cuba and Porto Rico. It intends to renovate old enterprises and create new ones in those prodigiously rich islands, and to that end has secured the co-operation of some of the most conservative men of wealth and enterprise, who, even under the late restrictive and oppressive régime, have gained distinction as merchants and administrators, and who, representing the new commercial aspirations of those communities, have enlisted both capital and experience in this undertaking.

"Under the new commercial conditions, industries, especially those concerns operating public franchises, will need readjustment, reorganization and development. This is the work the American Indies Company was organized to accomplish."

The incorporators are all said to be wealthy men, among them being Mr. Anthony N. Brady, well known to the electrical fraternity for his connection with the "Hucklebery Road," and as one of the directors of the Walker Manufacturing Company.

That there is an unlimited field for electrical undertakings in both Cuba and Porto Rico is not to be doubted, and it only remains to be seen what the American Indies Company will accomplish.

* * *

Electricity from the Sun?

The utilization of the sun's rays to obtain electricity is a problem on which scientists have been at work for a number of years. From time to time a sensational daily will announce in prominent type that a method has been devised to accomplish this, and that is usually the last heard of the alleged discovery. Some months ago Mr. Nikola Tesla was credited with having "harnessed the sun," and now we hear of another invention of similar nature by Prof. Elmer Gates of Washington. He claims to be able to draw electricity from the sun's rays by means of an ordinary battery cell, a magnet and a crystal. In an interview reported in the Philadelphia *Press* he is credited with the following statement:

"I took a cell just like one of these, and with the aid of a magnet and a crystal I secured enough electricity to operate a little motor. I brought it all about by simply reversing one of the currents, one of those two that are always moving in opposite directions. No, I am not reversing nature. It is simply taking advantage of one of nature's possibilities.

"Like every one interested in electricity, I have been deeply interested for many years in the solution of the problem of how to produce heat without fuel. The saving by such a discovery would, I realized, be enormous, and yet such a discovery to be of any practical value must be simple. Can you find anything more simple than a magnet and a crystal?

"I am not prepared to say yet just how I accomplished the result. I am not of a sordid disposition, but I am sufficiently worldly to understand the necessity of protecting inventions before making them fully public. But you can be assured that electricity can be drawn from sunshine just as you would draw cider from a barrel. The one process is as simple as the other."

That the heat emitted by the sun will eventually be made use of for power purposes is by no means improbable, but we question whether this will be accomplished in any such simple way as above stated.

It might be possible to concentrate the sun's rays in such a manner as to cause water to generate steam in a boiler, but in such an event some practical method of storing the heat obtained during the day for night use would have to be devised. In this connection it might be in place to mention a rather ingenious and unique scheme to indirectly make use

of the sun's rays for generating electricity on the Nile in Egypt. It is suggested that water be stored in sealed tanks with glass coverings similar to that of a conservatory. The heat from the sun expanding the air in the tank containing water, at the lowest level, it is thought, would force it into a tank at a higher elevation which would be kept cool by screening. This process would be repeated several times, the water each time passing to a tank at a higher level. It is then proposed to utilize the power of the fall for running turbines which would in turn operate dynamos. Whether such an arrangement could be made to work successfully is extremely questionable, but even such a scheme would seem more practicable than some of the suggestions constantly being advanced for the utilization of the sun's rays for generating electricity.

* * *

Determining Temperature Electrically by Sound.

An instrument has lately been placed upon the market by means of which the degree of temperature may be determined electrically by sound. This electrical auricular thermometer, as it might justly be termed, is the invention of Dr. George C. Whipple, biologist of the water-works in Brooklyn. It consists of a battery box to which is attached a long strand of insulated wire, the latter having at its extremity what at first sight appears to be a coil of ordinary bare wire, but which in reality is a hollow tube in which is imbedded two parallel wires, one of german-silver, the other of copper. An ordinary telephone receiver is connected to the other side of the box, while on the top of the latter is situated a dial marked with the degrees of temperature both above and below zero. A movable pointer is attached to the center of the dial. The modus operandi of the apparatus is simple. To determine the temperature of, for instance, a liquid, the bare tubing containing the german-silver and copper wires is immersed and the telephone receiver placed to the ear, when a buzzing sound will be heard. The pointer on the dial of the battery box is then moved around until the noise made by the diaphragm of the receiver ceases, when the degree of temperature of the liquid will be shown on the dial by the pointer.

The instrument is another exemplification of the Wheatstone bridge, the whole operation being simply one of balancing a resistance. At different temperatures the german-silver and copper wires do not offer the same resistance to the passage of the current, and of this fact Dr. Whipple has taken advantage and arranged a mechanical resistance in the dial box which may be made to balance the resistance of the bare wires, the telephone receiver being employed merely as a means of ascertaining when the resistances balance. An instrument of this description is said to have many advantages over the ordinary thermometer for special applications. For instance, an electrical sound thermometer can be installed in a large building in such a manner that the engineer located in the basement who has charge of the heating may, by placing the receiver to his ear and moving the pointer, ascertain the exact temperature of every room. The State House in Boston is thus equipped, and the arrangement there is said to have proved very satisfactory.

Another field open to the electrical thermometer would seem to be in cold storage warehouses. Heretofore when it was necessary to ascertain the temperature of any room in such a building it had to be opened, thus admitting a quantity of warm air, which was by no means desirable. With a view to doing away as much as possible with this opening of the rooms, the refrigerating plant was constantly kept operating under high pressure, which was by no means economical. Now each room in such a warehouse may be provided with an electrical thermometer, all the wires leading to a common switchboard. By connecting in circuit one room after another, placing the receiver to his ear and manipulating the pointer, a person would be able to determine the exact temperature of each apartment. But probably where a thermometer of this description would be most valuable would be in the workings of the United States Weather Bureau. One of the New York dailies referring to this invention recently, said:

"It is the purpose of Dr. Whipple to carry on a series of experiments with his thermometer attached to kites and balloons. It has been almost impossible with the apparatus which heretofore has been in use by the Weather Bureau to obtain a continuous record of the temperatures of the upper strata of the air. Yet upon this depends the efficiency of the Weather Bureau predictions. In fact, it is said that the meteorology of the future will depend mostly upon what is learned of the condition of the elements high above the earth. One of these instruments invented by Dr. Whipple could be sent up in a captive balloon or on a kite string and kept in operation for days. A very accurate curve representing the successive temperatures of the upper air might be obtained in this way. As the conditions which periodically affect the surface of the earth always exist up above for some time beforehand, some very accurate predictions might be made as to weather in store for us."

Under the Searchlight.

Notes and Comments on Various Topics.

IN the financial article of the *Sun* on Monday last, some of the recently effected combinations and some contemplated are referred to as follows:

In Brooklyn there has been talk of a sale to the largest owners of the Rapid Transit Company stock of enough of the stock of the Nassau Electric Railroad Company to give them the control of that concern also, while the amalgamation of the Edison Electric Illuminating Company of the same city with the Kings County Electric Light and Power Company, which has been pending a considerable time, is nearly consummated. An alliance of some sort between the Westinghouse Electric Company of Pittsburg and the Walker Company of Cleveland has also been announced. In addition, the committee of the minority of the preferred stockholders of the General Electric Company have formally given up their struggle against the majority, and submitted to be despoiled of 35 per cent. of the par of their holdings. Peace consequently reigns in the General Electric, as it did in Warsaw, after the Russian General had massacred half its inhabitants.

* * *

A CERTAIN remote town in Canada which, owing to its size, was unable to support a minister of the Gospel the year round, is said to have frequently been in straits during the prolonged absences of the holy man for some one to perform marriage ceremonies. A way out of the dilemma was thought to have been found by a keen-witted inhabitant in the phonograph. One of these was procured in which the nearest Justice of the Peace was induced to recite the marriage service, omitting names however. A number of impatient couples are said to have been married in this novel fashion, the names of the contracting parties being uttered at the proper moment by one of the witnesses. Marriage by phonograph was becoming quite popular and there was serious thought of permanently substituting Mr. Edison's invention for the services of a minister, when one of the cloth appeared in town and shocked the community by announcing that marriages consummated in this manner were no marriages at all in the eyes of the Lord. There was consequently a scramble to be remarried, the minister pocketing the fees.

* * *

THE following advice, although intended for English telephone service, might be occasionally found useful in this country:

To the Editor of the *Pall Mall Gazette*: Sir—It has been left to the Salvation Army to find another way out—this time of the telephone trouble. In their telephone boxes they place the following notice: "Ye have need of patience.—Heb. x. 8." May I suggest that the Secretary of the Telephone Company serve out to their clients a notice bearing a similar quotation? One might gaze at the text and breathe the sentiment as an excuse for saying prayers, and some of us may yet live to bless, and not to curse.—I am, Sir, yours truly, H. Greville Montgomery, Savage Club, August 26.

* * *

THE El Paso *Times* publishes the following interview, which is well worth producing if only to show that much-maligned Brooklyn has a formidable rival:

"Our Juarez street car lines," said Mr. Max Weber the other day, "are getting their concessions arranged for running electric cars, and we will be ready to put in an electric system as soon as the El Paso lines join us. I fear, however, that the people of El Paso and Juarez are not sufficiently advanced in street car civilization for electric lines. Why, electric street cars in El Paso would kill more people the first year than were killed in the war between the United States and Spain. In Juarez the street car mortality would not be so great because we have laws over here to keep the people off the tracks. But in El Paso the courts protect the people in sleeping on the street car track. Even with your present slow mule-box system it is necessary to employ a man to walk in front of the cars to persuade people camping on the track to get off and permit the cars to pass. In El Paso when a man gets too full of beer to fight he goes out to hunt a car track to lie down on and go to sleep, and if his slumbers are disturbed by a street car the courts make the car company pay the poor, over-worked, down-trodden sleeper big damages. Why, the El Paso street car companies have been sued fifty times for disturbing sleeping drunks, while our lines in Juarez have not had a single suit. In Mexico people are not allowed to go into camp on a street car track nor are children permitted to jump on and off cars in motion. I think it would be a good idea for El Paso to inaugurate a campaign of education; teach your people that a street car track is not a free lunch counter or a lodging house."

* * *

THE latest electric plaything is an electric cane lamp. The handle of the cane contains an incandescent lamp, the two poles of which are connected with the plates of a battery. Below this is a small chamber to carry the battery fluid. When it is desired to use the lamp the cap is taken off and the cane inclined, so that the liquid it contains comes in contact with the electrodes. A current is thus produced that will, it is asserted, keep the light going for an hour, which ought to be a sufficient allowance of time for the sometimes somewhat difficult search for the keyhole, provided that the lamp works.

* * *

Electricity for Tunnel Haulage.

THE passage through the St. Gothard tunnel is described to us, says the *Electrical Review*, London, by a recently returned traveler as having been something appalling during the recent hot season. With smoking locomotives burning briquette coal the journey of 9¼ miles, which occupies about 20 minutes, is almost unbearable. Our informant states that there is not far from the tunnel mouth a stream of fair size, which falls about 1,100 feet in a course of four miles by road, so that the water could easily be piped to Goeschenen, a distance of 2¾ miles by road from the Devil's Bridge, nearly 1,000 feet above Goeschenen, and utilized on Pelton wheels to work the tunnel by electricity.

* * *

THE *Electrical Engineer* of London aptly says: "What constitutes the claim to the title 'Electrician'? Whatever the answer may be, the self-styled or properly-styled electrician is having a rough time of it lately. The daily papers chronicle one shot at one place by roughs, another injured and sent to the hospital in another place, a third assaulted, and so on, till, as we say, the 'Electricians' seem to be having a bad time. Really there is little kudos in being styled an electrician when a wire-stretcher or a cable-layer is included in that category."

THE SINGLE VS. THE DOUBLE TRUCK CAR.

Mr. J. Hector Graham Takes Exception to Some of Mr. McCulloch's Views.

Editor ELECTRICITY.

DEAR SIR: I have read with interest the article by Richard McCulloch on the "Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use" that was read at the Convention of the American Street Railway Association, September 6 to 9, and printed in your issue of September 14, and I hope you will spare me space in your paper to show that Mr. McCulloch did not know what he was talking about, and that if he had acquainted himself more fully with the art that he professes in his paper to understand he would not have made statements that he has. There is one qualifying clause, however; he states: "In this paper the writer has not attempted to prove that either the single-truck or the double-truck car is the better type; he has merely attempted to discuss the subject to bring out the strong points and the weak points of each type." Well, he certainly brought out the weak points of the double-truck car. To quote more fully from his paper—he says: "Twenty-two feet may be arbitrarily established as the limiting length of the body of a single-truck car, and if we wish to use car bodies longer than this, we must adopt some truck which will avoid oscillation." I wonder how Mr. McCulloch can make such a statement as this in view of the fact that there are nine-bench open cars and twelve-bench open cars in successful operation on four wheels, and that they are from 30 to 34 feet in length.

In this city the standard open car is nine-bench, seating 45 passengers, and it is being carried on four wheels. Now to make a comparison that will show the development of the art, we will take a 60,000 lbs. capacity freight car with tare 40,000 lbs.; here we have 100,000 lbs., carried on eight 550 lb. wheels, each wheel carrying a load of 12,000 lbs. The weight carried per lb. of wheel is $22\frac{8}{11}$ lbs. The speed of this car varies from 20 to 40 miles an hour, and it is found to be a safe vehicle to operate.

Let us turn now to some of Mr. M.'s figures in reference to double-truck cars. If we take as a standard a 26 ft. car carrying 36 passengers, we find the weight of this car to be practically 24,000 lbs. He has not stated whether his wheel weighs 300 or 350 lbs., but I will take the wheel at 350 lbs. and we find that it carries a load of 3,000 lbs., and the weight carried per lb. of wheel is 9 lbs. Comparing this with a 20 ft. car weighing 16,000 lbs. carrying 28 passengers, considering the weight of wheel 300 lbs., we have a load per wheel of 4,000 lbs. and the weight carried per lb. of wheel is $13\frac{1}{3}$ lbs., showing that as between the weight carried per lb. of wheel in the two cars there is over 50 per cent. in favor of the short car, and as to the passengers carried, we find that the 26 ft. double-truck car carries 36 passengers; now as we desire to prove that Mr. M.'s figures are all wrong as regards the short car on four wheels, we have decided to take a nine-bench open car which carries 45 passengers and refer him to any number of twelve-bench open cars that seat 60 passengers, and frequently, on special occasions where traffic is heavy, these twelve-bench open cars on 4 wheels have been known to carry 125 passengers. We have the letters in our office from railway companies operating our 4-wheel trucks stating this to be a fact, and the round trip of 10 miles has been made inside of an hour. Mr. M. says: "Before the advent of the electric car, the horse car had become such an established institution in this country that certain standards as to track and rolling stock had become fixed." Certainly they had. For sixty years the leading car-builders of the country had been exercising all their skill and energy to build cars as light and strong as it was possible to do it, not for the reason that the horses could not pull the load, but because the railroad officials then desired to buy the very best in the market, as they did not want to pound their tracks out in five years or have their rolling stock racked to pieces inside of twenty years. The railroad officials then displayed not only considerable business acumen but also a great deal of mechanical skill, and to-day there are horse cars in this city running on 4-wheel electric trucks that are in a better condition after 10 to 15 years of service than some of the brand new 25-foot cars that have not been in service a year.

Mr. M. further states: "When a mechanical motive power replaced the horses this limit disappeared and almost the first improvement made in the rolling stock was to increase the size of the bodies." Now, as we stated in the beginning of our letter, if Mr. M. was familiar with the art he would have explained such statements as these. If the old horse-car body was strong enough to carry the load it was built for, and the weight of the car was made proportional to the weight of the passengers carried, why was this principle not carried out when electricity was adopted? For if there is a limit to the load the horse could pull, there must be a limit to the load the motor can pull; in the case of the horse it was corn, in the case of the motor it is coal, and both of these cost money. If it was good business policy to reduce the weight of the horse-car so that the horse would not be overloaded, would it not be a similarly good policy to reduce the weight the motor has to pull? Surely if it was unprofitable in one case it is unprofitable in the other, and to-day in the United States there is no department of the liberal arts or of manufacture that has been so hopelessly overburdened with the products of men who did not know and who do not now know the requirements that the art demands as electric railroading. Have the passengers increased any in weight to require an equipment three or four times as heavy as the equipment was when the horse was the motive power? These are questions that practical men like Mr. M. should explain before they begin to make comparisons between the conditions that are radically wrong to start with. Now Mr. M. goes on to state: "It is evident that since a car equipped with double trucks has eight wheels and one equipped with single trucks has four, the former will be more expensive to supply with wheels." That is so self-evident that it requires no demonstration even to the unwashed. Again he states: "It will be seen by reference to Table 1 that the greater part of the increased expense of maintaining the double truck is due to the renewals of wheels and brake-shoes." And again: "An examination of the tables will reveal the fact that the power required for the propulsion of the car, and the care and repairs which the motors demand, are much greater in the case of the double-truck car;" and that "the wear of the rails of a street railway track is due to the grinding action of the wheel on the rail, and this is proportional to the weight on the wheel, but is intensified by the dirt on the rail which causes the wheel to slip and act as an abrasive agent after the slipping has begun. The weak points of a street railway track, however, consist of the joints and the opening in the special work. The energy of the blow which the wheel strikes as it passes a low joint or a crossing is equal to the product of the weight of the wheel and the height of the drop." Therefore, we may add for Mr. M.'s benefit that there is to be added to the energy of the blow the load the wheel is carrying; when the load finds its support has dropped from under it, the load follows, and as the wheel sets itself in the low joint the car body comes down with it and the springs, which are usually placed on the axle-box, are compressed and the weight acts similarly to the spring handle of a sledge-hammer, adding greatly to the energy of the blow. Mr. M. continues: "Therefore on any given track both the wearing action of the wheel and the destructive action of the wheel are proportional to the weight which rests upon it." (To this we take decided exception, as we have stated above.) "If the number of wheels under a car be increased, the number of wheel blows which a low joint receives is also increased, but the intensity of each blow is diminished." If Mr. M. infers that the energy of the blow is decreased, he has not stated the case fairly, for this reason: in double truck the two wheels have a short, rigid wheel-base, when the forward wheel strikes the low joint it throws the blow back to the rear wheel and the rear wheel when it meets the low joint throws the shock forward, doubling the shocks instead of diminishing them, and it is not the energy of the blow that is destructive to the low joint so much as it is the number of blows—for instance, you go into a large forging mill and you will find that they have hammers that are quick in action and they repeat the blows as quickly as possible to accomplish the best results, and this is exactly what results from the double-truck car. Continuing Mr. M. says: "Double-truck cars are at no disadvantage as compared with single trucks in this respect, unless the weight of the car be increased." Well, if increasing the number of wheels and axles 100 per cent., together with the same increase in axle boxes, springs, journal bearings, truck frames, oil and waste and additional care, is no disadvantage, we respectfully inquire if it is an improvement. Sincerely, J. HECTOR GRAHAM.

Boston, Sept. 21, 1898.

COST OF ELECTRIC POWER FOR STREET RAILWAYS AT THE SWITCHBOARD, STEAM AND WATER POWER.*

BY R. W. CONANT.

(*Concluded from page 167.*)

[The tables and diagrams referred to in the following will be found in connection with the first part of Mr. Conant's paper in our last week's issue, reference being made to them throughout the whole article.—ED.]

I shall next call to your attention station No. 3, whose equipment differs from the standard as follows: It has two units instead of three. Each generator is 800 KW., making a capacity of about half that of the standard. The generators and engines are direct connected, the latter being compound condensing, smaller of course than the standard, but in other respects similar. Three 500-HP. water-tube boilers, economizers and heaters complete the important part of its equipment.

Group No. 3 indicates the cost of power for this station. At the extreme left is standard, the next column showing costs per KW. hour, averaged for one year. At the extreme right of the group is the average for a light month, and at the left of this is the month of high output. It is to be noticed that the total cost of operation for the year is somewhat greater than standard, coal expense practically the same, labor and general expense somewhat higher. Coal expense being the same does not in this instance indicate that the economy of the station is as good, as by referring to the table it will be seen that the pounds of coal per KW. hour are 2.61, as against 2.2 for standard. This increase is, however, nearly balanced by the reduction in the price per ton, which was $2 60, as against $3 for standard. It might be expected that on account of the diminished size of the station the labor expense would be larger on account of requiring more men per 1,000 KW. An examination of the table shows, in fact, that the men per 1,000 KW. is nearly double what is required for standard. This would double the labor expense, providing the rate of pay and load factor remained the same, but by a coincidence the rate of pay is

* Paper read at the Convention of the American Street Railway Association, Boston, Sept. 6-9, 1898.

lower and the load factor enough higher to bring the labor expense to nearly standard figures.

To illustrate the effect of a high load factor in reducing the cost of labor per KW. hour it will be interesting to look at the next shaded column for this station, which represents the cost during January. In this month the load factor was fifty-nine, as against forty-six for the year, and it will be noticed that the labor is reduced to less than the standard. The reduction in the total cost for this month, as against the yearly, is also apparent, and this is due principally to the reduction in labor.

It will be seen that the coal expense is but slightly less, and seems not to be much reduced by the increased load factor. The explanation of this lies in the fact that the station is tied in with others, which keeps its load from fluctuating even on the low load factor. This will be still further exemplified by referring to a light month; the column at the right of the group gives the costs for September, during which the load factor was forty-three, as against fifty-nine for January. The coal expense is still further diminished, and by reference to the table will be found to be due to an increase in the efficiency of the station. This might be found to be on account of not having to force the boilers. The increase of labor due to the low load factor is to be noticed.

I wish to say at this point that it is impossible for me in the limited time to give you more than a general idea of the large number of interesting facts which may be obtained by careful study of the tables.

Plant No. 2 is somewhat larger than the last, and is equipped with two 1,000-KW. generators direct connected to compound condensing engines. It has also economizers and heaters. Its costs are in column No. 2. In looking at the yearly average it will be noticed that the total costs rise above the standard, which is due to an increase in labor and general expense. Coal, as before, is the same, the decreased efficiency being balanced by the lower price per ton. Examining the table with a view to accounting for the increase of labor we find the load factor approximately the same as standard, but an increase in the number of men per 1,000 KW. This is accounted for by the smaller size of the station. General expense is greater, as would be expected. A glance at the shaded diagram representing the heavy month for this station gives a nice illustration of the effect of high load factor, which is fifty-one, as against thirty-three for the year. It is to be noticed that the coal is practically the same, the reduction coming in the other two items. This brings the total cost for the month below standard. In the light month, with a low load factor of 28 per cent., the labor increase is very apparent.

I shall now present the costs of operation of a large station. Its equipment consists of six 1,200 KW. generators direct connected to triple condensing engines, two 1,500-KW. generators direct connected to compound condensing engines, and an auxiliary plant of forty 62-KW. generators belted to compound non-condensing engines, and only used in case of emergency. Economizers, heaters and electric feed pumps complete the important part of the equipment.

Group No. 4 indicates the costs for this station. The yearly average shows that we are approaching standard figures in labor. This item is not much less, as the units are only of slightly greater capacity. Load factor, rate of pay and men per 1,000 KW. correspond very closely with standard. The general expense and coal bring the total somewhat higher. General expense is high on account of the heavy repair account. The station is about eight years old and repairs are heavy, due to replacing of worn-out parts. The decrease in efficiency, as shown by pounds of coal per KW. hour, might be shown by a test to be due to old boilers.

The plants just considered have all been direct connected. Station No. 5 is a belted plant a little more than one-half the capacity of the standard, equipped with seven 340-KW. generators belted to a countershaft, to which are belted three triple condensing engines, the auxiliary apparatus affecting the economy of the station being economizers and feed water heaters. Diagram No. 5 represents the costs of a year, and also for heavy and light months. During the three periods the coal expense remains about the same, but there is considerable variation in the other items, due principally to the change of load factor.

Notwithstanding the high load factor, 52 per cent. of the labor for the year is still above standard. This would be expected from the multiplicity of parts to look after in a belted countershaft station. The reduction of general expense and labor in the heavy months is due to the load factor of 64 per cent.

Diagram No. 6 represents the cost for a belted plant of about one-fifth the capacity of standard. Its equipment is twelve generators belted to four simple high-speed non-condensing engines. There are feed water heaters, but no economizer. High coal consumption is the feature of this diagram, the cost of fuel alone for the year being equal to the total operating expenses for standard. Labor is also high, and the total cost of power per KW. hour is nearly double the operating expense of standard. This station furnishes a good illustration of the effect on the cost of power of a simple non-condensing belted equipment. It is to be remarked also that this plant has the benefit of a high load factor.

It will now be interesting to turn our attention to a small direct connected station, which is numbered one. This operates about thirty cars. It is equipped with three 200 KW. generators, has compound condensing engines, heaters, but no economizers. It does not feed in with other stations, as do those which have been previously mentioned, and has a very fluctuating load, as may be imagined in the operation of so small a number of cars. This station is just one-sixth the size of the standard, and it will be noticed that the column representing its operating expenses is about twice as high. The great increase is in the labor, although the station is operated by a corporation which has had a vast amount of experience in railroad work. Can we account for this increase in labor? By referring to the table we find the rate of pay of men is practically the same as standard; the load factor is low, 22 per cent., as against 33.

Referring to the heavy month for this station, which has the benefit of a 30 per cent. load factor, we find that the labor is reduced, but it is still a long way from bedrock figures. The examination of the table discloses the fact that the increase comes in the men per 1,000 KW., being about 2.5 times the standard figure. The station records show the following men operating: On the first shift, two engineers and one fireman; second shift, one engineer, one oiler and one fireman; third shift, one engineer and one fireman. Can this number of men be reduced? In a station whose equipment requires that the boilers be hand fired it is, to say the least, difficult to imagine that the boilers could be operated with less than one fireman per shift. The secret then for the large number of men per 1,000 KW. lies in the small number of KW. capacity. These same men could look after a station of greater capacity.

I shall next give the costs on plant No. 12, whose figures are presented in Table No. 2. This plant is about one-third the size of the standard. It does not feed in with other stations. Its generators are belted to three tandem compound condensing engines, which operate under steam pressure of 110 lbs. It has water tube boilers averaging four years of service, heaters, but no economizers. A good quality of bituminous coal is used, which costs $2.93 per ton. By reference to the table it will be seen that this station produced power to the extent of 23 per cent. of its capacity during the past year at 1.49 cents per KW. hour, including fixed charges, the operating expenses alone amounting to a little over 1 cent. The total cost of operation for the year was $23,000, of which $13,610 was for coal. Water costs this station nothing, and the labor was about one-half the coal bill. By referring to the diagram No. 12 it will be seen that the coal and labor are both much higher than the standard, and if standard performance had been reached a saving of $10,000 would have been made in the operating expenses for the year. An analysis of the items is given in column No. 12 of the table, and by comparing with the standard the differences may be readily seen. I do not wish to be understood in making these comparisons that it would necessarily pay to make the changes required to effect this saving, my present idea being to bring clearly before you the differences.

Station No. 13 is an interesting combination of cheap coal, simple non-condensing engines direct connected to the generators, together with a high load factor. Its capacity is 70 per cent. of the standard, the major part being three 800-KW. generators; the smaller unit is 200 KW. It produced power to the extent of 42 per cent. of its capacity at .96 cent per KW. hour, inclusive of depreciation and fixed charges. The depreciation is charged in at 5 per cent. on a capital expenditure of about $60 per KW. The total expense for the year was $92,617.28, which is made up of—

Labor	$15,453.25
Repairs and renewal of steam plant	1,839.69
Repairs and renewal of electrical plant	56.71
Fuel	44,780.94
Water	4,405.40
Oil, waste and lubricants	1,881.53
Tools, appliances and supplies	634.23
Taxes	1,945.65
Insurance	2,146.94
Interest	11,472.94
Depreciation, 5 per cent. on $160,000	8,000.00
	$92,617.28

The analysis of these items is given for comparison with standard in column No. 13 of Table No. 2. The diagram shows labor for this station to be equal to standard, principally on account of high load factor, the other differences are also apparent. It is interesting to note that the road operated by this power station used on an average about 1.3 KW. hours per car mile. The total car miles for the year were 7,207,308, about 10 per cent. of this mileage being trail cars. There are other interesting data about this road which time will not permit me to review.

Plant No. 15 is an interesting example of what a multiplicity of units will do for labor, the figure being 6.3 men per 1,000 KW. The effect of this would be much more apparent on the diagram were it not for the high load factor and low rate of pay.

Plant No. 16 is of 1,600 KW. capacity. The cost for power for past year was $53,000. Load factor is the same as standard. Standard operates to produce about double the output for the same figure.

Station No. 28 is 1,400 KW. capacity, has slow speed condensing engines, heaters and economizers. The feed water leaves economizers at the high temperature of 258 degs. The engines are simple, belted to the generators and coal costs but $1.63 per ton.

Plant No. 29 is a compound condensing slow speed belted station of 1,900 KW. capacity, and feeds in with another station. The coal costs $3.86. Plants Nos. 30 and 31 are operated by the same corporation as No. 29.

No. 32 is a combination of two power houses feeding into the same system. These stations are interesting, because these costs are for the past year, and since then these two stations, as well as smaller ones operated by the same company, have been consolidated into a large water-power plant, from which power is transmitted at 13,000 volts. The two steam

stations shown in column thirty-two have five triple expansion condensing engines. This road operated on about 1.4 KW. hours per car mile. The coal costs $3 per ton. The water-power plant which replaced the steam has not been in operation long enough to enable its cost to be given.

Station No. 33 has rather a tall column, due principally to its low load factor of 16 per cent.

Station No. 34 operated at a lower cost than standard on account of the high load factor, 57 per cent., reducing the cost of labor, and low price of coal, $1 per ton.

No. 35 is a plant of 1,200 KW. capacity, interesting on account of the fact that it has but one unit. It operates with 2.1 men per 1,000 KW. a load factor of 37 per cent., coal costing $1.24 per ton. Its costs are quite a little lower than standard.

No. 37 is a record breaker in the opposite sense. It is of slightly greater capacity than No. 35, but has three engines and eleven generators, which require eight men per 1,000 KW. capacity. It has a load factor of but 11 per cent. during 151 days from January 1 to May 31, 1898. The effect of this on the cost of labor is very apparent.

No. 40 has a capacity of 9,200 KW. It is direct connected, has economizers and compound condensing engines. Anthracite coal is burned, costing $1.60 per ton. This plant operates at less than standard figures.

No. 42 is a belted plant, compound non-condensing engines, heaters, but no economizers. It has a good load factor, but the effect of the belted and small units shows in all three items.

No. 43 is a combination of alternating and direct current apparatus. It has a low load factor of 15 per cent. the effect of which is noticed on the labor.

No. 44 is a 6,000 KW. station, and, although belted, has large compound condensing engines and economizers, which, with coal at $1.60, brings the cost of fuel below standard figures.

It will now be instructive to take a general survey of the shaded diagram for all stations in Table No. 2. No. 37 towers above all the rest. Standard is at the extreme left. Coal in No. 37 is greater than the total operating expense for standard. This station pays but $1.75 per ton, but it uses 7.3 lbs. per KW. hour. Compare this with No. 35, about the same size plant, paying $1.24 for coal and using but 4.7 lbs. per KW. hour.

I can hardly ask you to compare the labor, but it is easily seven times as large in No. 37 as in No. 35. The load factor of 11 per cent. as against 37 per cent. would make this item three times as great, and men per 1,000 KW. 8 per cent. as against 2.1, would again increase the cost of labor three times. The higher rate of pay in plant No. 35 prevents the discrepancy being greater.

Let us look along the line for high coal cost. No. 16 seems to bear off the palm in this respect; $3.30 ton and 5 lbs. per KW. hour account for this. For strikingly low costs we have Nos. 34, 35 and 40.

But I am afraid that I hear somebody remark that I am making comparisons that may result in unfavorable criticism, and that I promised not to do, and therefore I will let the diagrams and tables speak for themselves, and assure you that they will reward careful study.

Tramways in Paris.

Paris is affording an example of the great development in tramways, says an English contemporary. The city is already well served with omnibuses, and has tramways driven by steam, electricity, cable and horse traction. The Conseil General of the department has just sanctioned schemes for three dozen new lines, providing better communication between the center of the city and the suburbs. The cars will be run by mechanical power and will pass through some of the finest boulevards and most crowded streets.

THE APPLICATION OF THE ELECTRIC MOTOR TO SMALL INDUSTRIAL PURPOSES AND ITS EFFECTS ON TRADE AND ON THE COMMUNITY GENERALLY.*

BY ALFRED H. GIBBINGS, M. I. E. E.,
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The electric motor is rapidly becoming the most favored medium for the transformation and transmission of energy for all industrial operations whether on a large or small scale. This is due to the paramount advantage it possesses over any other method of utilizing potential energy. These advantages are well known to electrical engineers, but indifferently appreciated by a large number of mechanical engineers, and almost unknown by the general manufacturer and tradesman. To the last of these three, the general manufacturer or tradesman who is using machinery driven at present by steam or water power, the electric motor must in the days to come prove of exceptional value; and yet, strangely enough, very little effort has hitherto been made either by the motor maker or by the managers of electricity supply undertakings to open up this very wide and lucrative field of enterprise. There is no necessity to enumerate here the many excellent and distinctive features which the electric motor possesses. The intention in this paper is rather to consider the reasons why its application up to the present time has been confined to a few special trades and manufacturers. We are familiar, for instance, with electrically-driven pumps, electric hoists and cranes, electrically driven machine tools, and electric power transmission in works—cases in which the generation, transformation and application occur practically under one roof. Many manufacturers and constructional engineers, wisely and readily incurring additional capital outlay with the object of securing more economical production, have adopted electric motors, which do not entail the use of endless and power-absorbing shafting and countershafting. As yet, however, it cannot be said that the electric motor is in general use, or scarcely other than just past the threshold of its future domain. I shall endeavor to show how large a sphere of influence it is destined to fill. The smaller producer and tradesman, to whom motive power in some form or other is essential, and who feels more acutely than his larger *confrère* the effects of competition, has in the great majority of cases still to put up with very much more cumbersome and very much less efficient means of power production. Almost every town with any pretension to size and importance has its own large staple industries, as well as many minor industries and businesses, requiring the use of other power than hand power. There are also some handicrafts which are at present unavoidably confined to hand power, because steam, gas, oil and hydraulic power are each and all inapplicable. There can be little doubt that the electric motor would be welcomed and readily adopted in these cases if only its simplicity and adaptability were known and understood. I will give a somewhat full, though by no means exhaustive, list of these trades: acid manufacturers, agricultural implement makers, automatic electric signs, back and vat makers, bag makers, aerated bread makers, basket makers, bicycle makers and repairers, boiler makers, book binders, boot makers, boot polishing, bottle cleaners, bottle makers, box makers, brass finishers, brush makers, cabinet makers, carpenters, carpet beaters, coach builders, coffee grinders, coopers, cutlers, cranes, dairymen, dentists, engineering workshops, engravers, fans for ventilating and other purposes, forage cutters, forced draught, founders, grain elevators, hoists, hair-brushing machinery, laundries, lifts, lithographers, mill-wrights, musical instrument makers, oil refiners, opticians, organ builders, organ blowing, packing-case makers, paper makers, pianoforte makers, picture-frame makers, presses, printing machinery, pumping, racket makers, rope makers, sack makers, saddlers, sausage makers, saw makers, saw mills, scientific instrument makers, seed crushers, sewing machines, shop fitters, smallware manufacturers, smelters, smiths, snuff manufacturers, soap makers, stick makers, stuff manufacturers, sugar refiners, surgical instrument makers, theatrical machinery, timber merchants, tinplate workers, tobacco cutters, tool cutters, tool makers, toy makers, turners, umbrella makers, undertakers, watch makers, wire drawers and workers, zinc workers, etc. Other special and local industries will occur to you without enumeration which can be placed in the same category.

The advantages of driving electrically in some of these cases are of a very distinctive character, and it will be well to consider briefly one or two prominent examples.

Boiler Makers.—The practice of drilling all rivet-holes in boilers with the overlapping plates *in situ* is an operation which is much more rapidly, readily and economically performed if the drilling machines can be brought to the work instead of taking the shells to a fixed machine tool and there adjusting them for every fresh set of holes to be drilled.

Book Binders, Boot Makers, Cutlers, Presses, Saddlers, Saw Mills, Smiths, etc.—These trades are instances in which several machines are frequently employed, but of which intermittent use only is required. By any method of driving, other than by electricity, it is incumbent to employ lines of shafting and countershafting, and to keep these in continual motion in order to use any one machine when required. In such cases, by direct coupling to the machine to be driven, and by its unequalled facility for starting and stopping, the electric motor has unique and all-important advantages.

Letterpress and Lithographic Printing.—This class of machinery has been successfully operated for upwards of two years by electric motors applied direct to the main driving shaft of the machine or by toothed gearing. Since the first attempts were made many improvements have been introduced, until at the present time nearly all the leading houses in the trade have either adopted the system of single-machine driving in its entirety, or some such modification of it as best seems to suit their particular methods of working. It is doubtful if printers realize the immense loss that occurs by the old method of driving. Wherever the system of shafting and belts is used to transmit the energy generated by the driving engine there is a great loss of power, not only so, but a mass of machinery and gearing has to be kept wastefully running whilst possibly only one or two machines may be utilized. In one case where tests were made it was found that the shafting and belts absorbed 56 per cent. of the actual power generated by the engine. In this industry the extremely steady and even motion imparted by the rotary action of the electric motor is also an important feature.

Cranes and Hoists.—In almost every town there are warehouse and other cranes, and passenger and goods hoists, in general use. The advantages of the electric motor for these purposes are (1) the possibility of placing the motor close up to its work, (2) direct coupling or reduction gearing of high efficiency, and (3) the economy resulting from the power used being practically proportionate to the work done.

There is no need for me to give you further examples in detail. The application of ordinary mechanical tests for efficiency, and the experience already obtained by the substitution of electric motors for other methods of power production, have proved beyond doubt its exceeding adaptability and superiority. Notwithstanding all this, however, many obstacles yet remain to hinder its general adoption

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by what may be termed the commonalty of the manufacturing world, and among the principal may be mentioned the following:

1. The extreme aversion to innovations which characterizes the industrial world in this country especially.

2. The existence of other motors in good working condition.

3. The unsuitability of alternating currents of electricity for motors where the power required exceeds 2 HP. or 3 HP.

4. The want of capital to lay out in new machinery.

5. The want of confidence in the electric motor by the non-technical manufacturer.

The first and second points do not require any further commentary or elucidation, and I shall therefore dismiss them without more observation. With regard to the third point, it is much to be regretted that the alternating-current motor is not yet capable of doing the same work as a continuous-current motor. The energy required to operate either type must, of course, be derived from some source—usually a steam dynamo—from which distribution mains carry the current in any direction; and as this is the most efficient method known of transmitting energy and the motor the most efficient medium for transforming it into useful work, the principle has been applied in the workshop as well as for public supply. There is no need to dwell upon the advantages of the centralization of steam power, nor upon the universally admitted fact that electricity for power purposes can be supplied from public lighting mains at a very low cost. But in addition to these there is one equally important advantage of deriving power from public mains from the user's point of view—I refer to the actual resultant taken on the average of the varying loads, which is characteristic of the electric motor, and the facility for instantaneously switching "on" and "off" as required. This feature is illustrated in the curve shown which has been taken from the most modern machines. It will be seen that the maximum horse-power was 6.4, and the duration of time 18 minutes, which, if the maximum power had been a constant load, would represent approximately 2 horse-power hours. But after the resultant had been carefully obtained with a planimeter, the actual horse-power hours are found to be 1.06. This difference between the maximum horse-power required and the mean horse-power used is rarely taken into account or even understood by many small power users—it is a most difficult thing to get them to appreciate it.

The chief obstacle to the more rapid adoption of electric motive power, especially in the case of small tradesmen, throughout the country is undoubtedly the want of capital to purchase the necessary motor; but where the power to purchase exists, the buyer will probably have little or no experience or knowledge of electrical matters to guide him in his purchase; if his means are at all limited he will be tempted to venture on a cheap line, and become the dupe of those who simply make to sell. The solution of these difficulties—which to my mind appears the most satisfactory, because it is the one fraught with the greatest advantages to all concerned—is that the owners of electricity supply undertakings, whether a public company, municipality or other local authority, should themselves purchase good, reliable motors, and let them out on hire. Antecedently this scheme may appear a sort of parental regime, but it is suited to present circumstances at any rate, and experience proves it to work well. Unfortunately, all local authorities have not got powers to borrow money for this purpose, although it appears from the Electric Lighting and Public Health Acts that borrowing powers may be granted by the Local Government Board for works of a permanent nature. Electric motors do not yet come within that category, although gas-stoves do, a legal decision having been given in their case. All future municipal parliamentary bills should therefore contain clauses which would confer such powers and secure freedom of action in this respect. I do not propose here to run into elaborate details with regard to terms or general scheme of hire, but I may say that in Bradford we have found a rental charge of 10 per cent. upon the initial cost of each motor to be amply sufficient. This is made up of 3 per cent. for interest, 3 per cent. for sinking fund, and 4 per cent. for depreciation and contingent expenses. The Bradford Corporation inaugurated their scheme of hiring (in which also aro lamps are included on similar terms) in November, 1896, and the following table will show the extent to which these facilities have been appreciated:

Year.	Number of motors supplied from Corporation mains.		Board of Trade units sold per annum
	Owned by consumer. Not on hire.	Owned by Corporation. On hire	
1885	35	nil.	35,919
1886	23	7	84,972
1887	14	39	117,176
1888 (Six months only).	6	22	63,820.

From this table it will be seen that the increase in electricity supplied for motive power in 1896, in which year the hire system had been in operation for two months only, was 19,053 units; in 1897 the increased sale over 1896 was 52,204 units, and in the present year the increase is likely to be 62,834—or a sale of 180,000 units, or 53 per cent., over 1897.

Hitherto the supply has been confined to small power uses, such as cranes, hoists, fans, pumping, aerated water making, electric advertisement signs and similar purposes. During the last month, however, so popular has the electric motor become that applications have been received from a large spinning and weaving firm, two foundries for blower purposes, an engineering shop requiring 50 HP. and a saw-mill requiring about 20 HP. I referred a moment or two ago to the want of confidence of the small power user in the electric motor; that confidence, however is soon gained. It is gratifying to be able to state that several consumers in Bradford who originally applied on the hire system, and at the time with much trepidation and many inquiries, have since decided to purchase the motors outright. The accompanying table has been compiled from replies to an inquiry which I made recently of each municipal electrical engineer where the continuous current system has been adopted, and from it may be gathered the extent to which electric motors driven from electric lighting mains have been employed. The figures given are up to the end of 1897:

Town.	Population.	Number of motors supplied.	Total HP. of motors.
Aberdeen	140,000	14	65
Bradford	231,260	119	470
Brighton	122,310	100	......
Belfast	320,000	......	165
Birkenhead	110,000	4	15
Bury	63,000	5	12
Blackpool	40,000	7	7
Burnley	90,000	8	32
Chester	87,100	20	70
Dewsbury	29,847	4	16½
Dundee	169,000	15	20
Edinburgh	295,000	167	343
Glasgow	750,000	37	131
Hull	213 000	14	46
Lancaster	38,224	28	80
Liverpool	641,063	57	152
Manchester	505,368	257	696
Norwich	101,000	61	120
Nottingham	213,877	18	50
Oldham	148,000	11	60
Southampton	90,000	18	23
Shoreditch	124,000	31	434
Sunderland	147,000	23	240
Wolverhampton	92,000	2	8
Whitehaven	20,000	....	......
Walsall	72,000	7	13½

I have endeavored in this paper, and in the necessarily limited time and space at my disposal, to place before you the outlines only of a method of extending the adoption of electric motive power by the general manufacturing community. Those who have the management of public electricity supply undertakings know full well the value of the electric motor as a factor in the reduction of the working costs, which is also the principal argument for the combined working under one roof of electric lighting and electric tramway systems. But there are other and probably greater effects which the electric motor will produce with its more complete adoption in the near future—I refer to the beneficial effects upon the trade and productions of the country, and the hygienic and social effects on the community generally. In the first of these aspects it is possible to foresee the revival once more of a number of small and independent industries—such as existed, but under very different conditions, in former years. The possibilities are already being grasped by the artisan in France, Germany, Switzerland and the United States. By the aid of the electric motor he begins to find that he can at least hold his own in competing with immense manufacturing concerns and combinations; he has a practically unlimited available power at his own door—which is a great boon to the artisan, and one which offers him an inducement to become his own master. In a very small and limited degree the gas-engine has already accomplished something in this direction, but its many imperfections, its cost, and the fact that it has never been available on the hire system, have kept it more or less in the background. The effect of hiring-out is thus mutually advantageous and its natural tendency is to create fresh demands; in fact, the municipality which includes this scheme in its electric light undertaking offers a great inducement to the influx and establishment of new industries within its area. With a more complete return to a multiplicity of industrial operations, there may also revive some neglected trades—such as those which have passed from us to other countries, and which now form our imports. From a hygienic point of view the electric motor is far and away the best; it is cleanly in its working, gives off no deleterious gases, and displaces the boiler and smoky chimney. One of the ultimate results must also be the raising of the status of the working part of the community. By becoming his own master the artisan gains self-respect, becomes more resourceful, and therefore a more important member of society; and the more intelligent interest which he will display in his business must appreciably affect the general welfare of the country.

ELECTRIC SIGNALING IN THE GERMAN NAVY.

BY BEAUMONT PONTIFEX.

A system devised by M. Kaselovski, which is worked by various combinations of incandescent lamps, has been adopted for the vessels of the German navy. The whole design of the apparatus is based on the following considerations: (1) the use of *one* switch key only; (2) moving the key from one signal to another must break *both* poles of circuit; (3) great mechanical steadiness; (4) immunity from damp.

The most important item is the switch. On large vessels this is carried on a pedestal on the bridge, but on torpedo boats, etc., it is fixed on the after side of the conning tower. The switch is contained in a cylindrical brass case, which carries on its base a flange for bolting to supports and a socket-union for the seven-pin end of the flexible cable, the flange being left hollow for the leads from source of supply, which is usually the incandescent lighting plant of the ship. The top cover of the switch contains the indicating disks, which are made of colored and marked glass to correspond to the prearranged signals and give the proper direction to turn the key to indicate same. These glass disks are arranged in a circle round the edge of the cover, and are lit by an incandescent lamp inside the case.

The actual contacts of the switch consist of plun-

gers pressing against recessed gunmetal disks, fastened on a central spindle and insulated from it. The plungers are driven against the disks by spiral springs, but their travel is limited by collars, so that when a recess in one of the disks is brought opposite a plunger contact is broken. The recesses are so arranged that by turning the key the circuits are by turns closed and opened, whereby, according to arrangement, one, two or three incandescent lamps out of six are lit in succession. There are also two plungers on the opposite side of the disks, which throw in and out of circuit one, two, or three lamps used as a compensating resistance. Two separate plungers pressing on the lower part of the spindle serve to break contact on the common return wire whenever the spindle is lifted to allow the key to move from one contact to another. The entire switch is easy to handle, and is quickly taken to pieces for repairs or renewal of springs, plungers, etc. A seven-core flexible cable is used, one core being a common lead to all lamps, the other six being individually connected to the opposite pole of each lantern. There is a central steel wire to add strength to the cable, and the whole is thickly braided.

The lanterns are two-light fittings, the upper half white and the lower red, carried in a frame of flat iron. The glasses are of the usual "well" pattern, secured by rubber washers held in an iron rim by bolts. The lamps are hung one over another at fixed intervals on the mast, so arranged that the white lights are on top and the red underneath them. Each lantern has a two-way socket at the side, to which is screwed the connecting plugs on the cable.

When not in use, the entire gear is stowed in an iron box resembling both in shape and size the familiar household sanitary dustbin.—*Electrical Engineer, London.*

EQUIPMENT AND MAINTENANCE OF ELECTRIC CARS.*

BY M. S. HOPKINS.

An ancient king of fable offered a rich reward to the courtier that could tell a story that would last forever. To him that undertook it and failed the price was his head. Were this merry monarch living to-day he might gratify his wish by asking, "how shall I best manage my street railway?" and all his newspaper editors, councilmen and other subjects would at once undertake the task, for it is a matter of common knowledge that everybody can manage a street railway much better than it has ever been managed.

The modern king of finance is daily asking this question of his hired subjects, and unless the answer is expressed in dividends the story is at an end and the head of the manager is the penalty of failure. To attempt to discuss all of the various elements entering into the composition of a successful street railway would be a continued story, and not within the province of this paper. What is the best electric equipment to purchase and how can it be made to render the best service at the least cost, is the question which daily confronts the street railway manager, and one on which he is constantly seeking advice. There can be no answer which is applicable to all street railways, and no especial merit is claimed for the views set forth other than that they are the result of experience and born of repeated failures and successes.

CAR EQUIPMENT.

No fixed rule can be laid down for the selection of equipment, as climatic conditions, character of traffic, frequency of headway, conditions of roadway, municipal regulations and grades are all elements which determine what the equipment may or should be.

ELECTRICAL EQUIPMENT.

In the selection of the electrical equipment the main point is to secure equipment of ample capacity and proper design for the service required. In a railway motor, the mechanical and electrical features which influence its maintenance should receive very careful consideration. The bearings should be large and lubricated by oil from below and cup grease from above, and so designed that the drip from the bearings will fall outside of frame. The armature should be so constructed as to permit the shaft being pushed out without disturbing the commutator and winding.

I am glad to note that the importance of light weight and slow peripheral speed of armature has been recognized in the recent design of railway motors. The inertia or flywheel capacity of the armature should be the smallest possible, consistent with the work required. Engineers differ as to the best method of suspension. From a theoretical standpoint the cradle or side bar suspension has the lead. The dead weight is largely removed from axle, thereby eliminating to some extent the hammer blow on rail joints, decreasing the wear on axle brasses and s curing the better alignment of gears; yet, in practice, the nose suspension is still preferred by the writer, as the car starts more smoothly—the weight of motor on spring supports overcoming the jerk and quiver so common in other methods of support. The specifications for railway motors as drawn up by leading manufacturers of to-day amount to practically nothing, and I would suggest that the purchaser of motors in his specifications clearly define the rating, heat limit and efficiency.

The series parallel controller is in most respects a satisfactory device, the chief objection being the narrow range of speed on running notches. Specifications for resistance should provide that the last two points of resistance be of sufficient capacity to allow of their continued use as running notches, especially where cars are operated in city service.

There are several types of magazine fuse boxes or cutouts and single cutouts using a special fuse which possess a number of points of merit. Without going into detail, it is the opinion of the writer that under average conditions the standard magnetic blowout fuse box, using a link fuse, is preferable.

Where side sills are plated on outside with steel plates, all season cracks should be thoroughly filled with a thick mixture of lead and oil, and entire surface given a heavy coat of oil paint before plate is put on. It is hardly necessary to say that all joints should be well leaded and protected from moisture. A heavy steel roof rafter in one piece should be put in at every post, and a saving in maintenance will be made by having platform floors of oak or maple. The trolley stand should be mounted on a trussed support, which will distribute the strain to the ends of car as much as possible.

Ash seems to be almost universally used in post and light framing of cars. This is probably due to the difficulty in securing the grade of oak necessary, the lighter weight of the ash, the greater ease with which it is worked. In spite of these difficulties, oak is far preferable, being stronger and more elastic, and will give a far longer life.

TRUCKS.

Under the average conditions 22-ft. closed car or eight reversible seat open-car body should be the limit for a single truck. Although there are single trucks which will carry a longer body fairly well, yet the increase in maintenance will in most cases warrant the use of double trucks. The local conditions should govern the type of double truck used, the bolster type in most cases being preferable for long cars on high speed suburban service, while for city service, where heavy grades and quick starts demand maximum traction, and short curves make it necessary for the wheel to turn under sill, the bicycle type must necessarily be used. This type of truck is no longer an experiment, and while they possibly require more careful inspection and adjustment, very efficient service can be secured from trucks of this type.

Trucks should be made up of a small number of parts, cast and malleable pieces should be the lightest consistent with strength. The springs should be so arranged as to prevent oscillation and give an easy riding car under all conditions from no load to full load, and when the style of truck is of such design as to prevent the use of an under truss, the spring base must be exceptionally long and the end springs so arranged as to relieve the strain on the car sills.

The brake mechanism should be so designed that the strains will be equally distributed on all parts throughout its range of movement. The pins should be of ample size to provide for wear. The slider method of support for brake beam will be found more satisfactory than the loop support. The minimum amount of friction should exist between brake staff and shoe, and release springs as light as possible.

CAR BODIES.

For years car builders have attempted to devise a car body which would be equally durable in both summer and winter, but judging from the character of equipment now in use on the majority of roads, such a car has not yet been produced. The combination car with movable parts is not satisfactory for winter use, is troublesome, noisy and cold, and is lacking in many of the essential features of the open car for summer service. The open cross-seat car of the barge type, with running boards on the side, seems by far the most desirable type of car for summer service, affording the largest seating capacity and the best facilities for receiving and discharging passengers, which is a great advantage in city service. Considering all features, the box car with side seats, large windows, wide end door to the side of center, roomy platform and vestibules closed on one side, seems best adapted to the average condition of winter service. While the vestibule type closed on one side is not so convenient for the handling of large crowds, yet the additional safety afforded on double-track roads should receive full consideration even at the expense of convenience. In localities where winters are accompanied with snow fall and freezing weather, the vestibule affords protection to passengers, and motormen and conductors are able to render very much more efficient service.

The long car body seems to be growing in favor with the railway manager, due to the comparatively small increase in operation in comparison to increased carrying capacity, and its allowing of the increase of headway or decrease in number of cars run, resulting in a large decrease in operating expense per passenger carried.

The purchaser of car bodies should have a clear conception of the details of car construction, and specifications should clearly set forth the essential features, minor details of interior finish and decoration being left to the manufacturer.

In the construction of box-car bodies, the trusses should be as deep as possible and great care taken to secure a perfectly rigid fastening at end of sill, as the slightest deflection throws an undue strain on joints and framing of car body.

Each car should be equipped with a thoroughly reliable lightning arrester. The points to be noted in selecting this device are as follows: The kicking coil should always be installed; the air gap should be as small as possible; there should be a positive and quick device for interrupting the current after discharge, and one which will not be injured by discharge; there should be a non-inductive resistance in the main circuit which will limit the flow of current and thereby prevent the opening of the circuit breaker at the station when several arresters operate at the same time.

One of the most puzzling problems brought before the manager to-day is the amount which should be expended in the maintenance of old equipment before it should be replaced by new. To the average master mechanic this would seem a simple problem of mak-

* Read at the Convention of the American Street Railway Association, Boston, Sept. 6-9, 1898.

ing a careful estimate of the difference in cost of maintenance of the old and new equipment, due consideration being given to the interest on money invested in new equipment and its increased efficiency. Still after the master mechanic has conclusively shown that by putting in new equipment a marked saving can be made in cost of operation, the manager has to consider the financial condition of the property, the advisability of increasing the investment, the possibility of doing so, and whether there are not other departments of the road where a greater saving can be made by increasing the investment. One should go slow in putting in new equipment, as new apparatus may at first seem to be void of the main defects inherent in old equipment, yet when put in operation other defects occur which under the varying conditions may prove even more disastrous than the old.

MAINTENANCE OF EQUIPMENT.

The cost of maintaining equipment depends on various complex conditions, some of which are beyond control of the manager, and others for which he should be directly responsible. Heavy grades numerous railway crossings, sharp curves, dirty and unpaved streets, imperfect and poorly constructed equipment, long and severe winters, all affect cost of maintenance unfavorably and are beyond control of the manager. But the character of men who operate the cars, the manner of operation, the way in which repairs are made, the character of men engaged in repairs, and the material used, are the controllable elements and in most instances the chief features affecting maintenance.

CARE OF EQUIPMENT IN CAR HOUSES.

Generally one of the following three methods is used for daily inspection of car equipment, namely: inspection of cars for each trip, inspection of equipment at night by motor inspectors, inspection of equipment during the day by motor inspectors and repair men.

In regard to the first case, that of the trip inspection, I would say that in the present degree of perfection attained by manufacturers of railway equipment, trip inspection should not be necessary, and, excepting on interurban lines operating at high speed over long runs, is of doubtful value. It is expensive, requiring the services of an inspector who is necessarily a man of some ability for each line of cars. The period of time for making this inspection is necessarily very short, and the entire time is taken up in mere inspection—little or no opportunity being afforded in which to make repairs.

In regard to night inspection, the experience of the writer has been such as to absolutely condemn such a method as expensive, slovenly and unsatisfactory. It is impossible to make a thorough inspection of cars at night, no matter how well lighted the car house may be, and the efficiency of the work done by the men is very far below that of the work during the day. Therefore, when local conditions will admit, inspection of cars during the day seems by far the most advantageous.

We will assume a car-house station, from which twenty-five or more cars are operated. There is usually one general foreman in charge of this station. His duties are chiefly those of the transportation department, but he should be a man thoroughly conversant with the usual trouble which may occur in the operation of the equipment, and know how to direct minor repairs. It would be better, of course, if he were able to personally superintend the actual work of repairs, but it is usually very difficult to find men who are good mechanics and likewise efficient in the transportation department.

For making inspection and running repairs such as should be made in car houses, it is a safe rule to have one man to seven cars. It is important, however, to have in all car stations a man known as chief inspector of that division, who is thoroughly conversant with practical electrical and mechanical matters. This chief inspector should have under his care for inspection and repairs seven cars, and also have direction and supervision of the other two repair men who care for the remaining eighteen cars.

It is important that the responsibilty for the proper repair of cars be definitely located, as nothing is so demoralizing to the force of motor inspectors as to have a case of trouble arise and not be able to trace the responsibility at once to the proper source.

The duties of these men should be to make a daily inspection of every car assigned to them, starting first with their motors, examining the grease cups, the brushes, cleaning the motors, examining connections, etc. They should remove the covers from their controllers about once in three days and oil the cams very lightly with vaseline or grease, remove any blisters which may have appeared on the contact points and carefully examine the adjustment of contact fingers. Too much emphasis cannot be given to the inspection of all brake rigging, and very thorough inspection should be made daily from the brake-handle to the brake-shoe, and the brakes tried by inspectors before the car is placed in service. A broken brake-chain or worn-out shoe, a broken brake-clutch or a broken brake-pin are things that should never occur through neglect, and if an accident of this kind does occur, the cause should be immediately traced and the responsibility located. Economy in maintenance should never be exercised at the expense of absolute safety, and brake-chains, pins and shoes should be discarded long before the danger point is reached.

The general public forms its opinion of maintenance of equipment by the little things on the interior of the car, such as a screw loose in the back, a broken strip on the floor, loose register pulley, broken hand-strap, broken glass, rattling glass and hundreds of other little things which make the fittings of a car body. Repairmen and inspectors should be so trained that in passing through the car on their inspection they should note any little thing of this kind at once, and the rule should be that they stop and repair it at once, for if allowed to wait till some other time the repair is usually neglected entirely.

The actual repair work done by these inspectors should be all work possible to be done without the use of machine tools, or which, if done by them, will not require the loss of the car from service for a period of more than two hours.

If during this inspection the motor inspector discovers trouble which is beyond his ability to repair, he should fill out a repair slip and send the case with the slip at once to the repair shop, stating the nature of the required repair, assuming that the repair shop is run as a separate department from that of the car barn. If the nature of the trouble is such as not to immediately incapacitate the car for use, but which requires the services of the repair shop department, he should fill out the blank as above noted and send same to the foreman of repair shop, but this notice to the repair shop foreman should in no way release the motor inspector from the responsibility of the successful operation of the car. If the repair shop foreman is unable to take the car off the road at once, owing to press of work, it is the duty of the motor inspector to watch continuously the development of the trouble, and if at any time he thinks it has so advanced that car is not safe for successful operation he should leave the car out of service, and so notify repair shop foreman. If the latter is still unable to receive the car at the shop he should then make a personal examination of car and assume responsibility for its further operation.

The questions as to how often car equipment should be taken to the shops for a general inspection and overhauling, and to what tests the electric equipment should be given at the time of inspection, are subjects upon which electrical engineers widely differ. Considering the average conditions, and assuming that the equipment is in good condition, it is the opinion of the writer that the taking of cars to shops once every six months should maintain the equipment in good condition and assure its efficient operation.

(To be continued.)

Electricity in a Japanese Iron Works.

The *Elektrotechnischer Anzegier* contains a note to the effect that the iron and steel works in Yawatanura, belonging to the Japanese Government, are using electrical power to drive the individual machines. The electrical equipment, which is being supplied by Messrs. Siemens & Halske, comprises three steam dynamos of the continuous current type with internal poles, the aggregate capacity being 1,750 HP. Current is supplied at 250 volts to several hundreds of motors for various purposes, for cranes and motors up to 100 HP., pumps of various sizes, blowers, and for all kinds of machine tools. The works are also lit by electricity.

The Evian-les Bains Three-Phase Tramway.

On June 10 last, says the *Electrician*, London, a small three-phase tramway line was opened at Evian-les-Bains, a popular watering-place on the French side of the Lake of Geneva. The tramway leads from the Hotel Splendide to the Avenue des Sources, where the springs are. The hotel, although overlooking the avenue, lies at a higher elevation, and the line follows an S-like course, rising 67 ft. in a length of about 330 yds., a mean gradient of 6.8 per cent. The maximum gradient is 10.2 per cent., and the sharpest curve occurs on this part of the line, and has a radius of 49 ft.

A three-phase system was chosen as there was already a three-phase station eight miles distant; this system also having the advantage that the motors have no commutators requiring attention. The pressure at which the current is transmitted is 5,200 volts, the frequency is 50 cycles per second, and the same transmission line is used for light and power. A 30 kilowatt stationary transformer converts the pressure of each phase to 200 volts, this transformer also furnishing current to drive a 6 HP. motor for the pump of the hydraulic lift in the hotel. The two trolley wires are of 6 mm. hard-drawn copper, and are supported 11¾ in. apart on ornamental steel posts with brackets. The rails form the third conductor, and they are bonded in the usual manner. The line is single-track, and there are no crossings as only one car runs on it.

This motor car weighs 3.8 tons, has seats for eight, and standing room for six more passengers. The interior of the car is luxuriously upholstered and provided with a carpet, and two incandescent lamps are used to light it. The two headlights are also electric. A light two-axle truck supports the car-body, being fitted with one three phase motor only, whose normal output is 15 HP., although it can develop 25 to 30 HP. for a short time. The motor-shaft makes 750 revolutions per minute and drives a countershaft through spur-gearing, the countershaft being connected to the axles by chain-gearing. This arrangement is said to have been necessary to obtain sufficient adhesion. The field of the motor is stationary and the armature revolves, being connected to the starting resistance by means of brushes and contact-rings. Each platform is provided with a simple starting-switch and an emergency switch. The motor is in circuit both during the ascent and descent; in the latter case it acts as a brake, the motor running as a generator slightly faster than the speed of synchronism. If one of the trolleys gets off the wire, the motor continues to run as a single-phase motor; if both trolleys fail, the hand-brake must be employed.

A contrivance for strewing sand on to the lines is fitted at each end of the car. This consists of two horizontal cylindrical shells, one within the other, the inner one having a slit parallel to the axis. This

inner cylinder, which contains the sand, is turned with the slit upwards in its normal position, and when sand is to be strewed on the track it is revolved slightly by a hand-lever, thus tipping sand into the outer cylinder which is fitted with funnel-shaped orifices to direct the sand on to the rails.

The car makes about 60 double journeys a day, and its speed is 6½ miles an hour in either direction.

The permanent way and transmission line were built by the firm of Lombard et Cie. of Lyons, the motor car and electrical equipment by Messrs. Ganz & Co. of Budapest.

A Big Company Incorporated in Jersey.

The Jersey City *Journal* of the 22d inst. has the following announcement:

"A certificate of incorporation of the North Hudson Light, Heat & Power Company was filed in the office of Secretary of State at Trenton last Monday by Counselor Spencer Weart of this city as attorney. The capital stock is $2,000,000, divided into 20,000 shares of the par value of $100, and the principal office is to be on Bloomfield street near Fourteenth street, the present office of the Hudson Electric Light Company, which concern the new corporation has purchased.

"The incorporators are: Albert B. Carlton of Elizabeth, Frank M. Stillman of Rahway, Samuel Hathaway and George W. Waite of this city, David Young and George W. Roe of Newark, and Arthur K. Bonta of Hoboken. Each incorporator has subscribed to twenty shares of stock and the new company starts in with $14,000 capital paid in. Mr. Bonta is the present superintendent of the Hudson Electric Light Company, and it is stated will act as manager of the new corporation.

"The articles of incorporation state that the objects of the new company are to construct, purchase, lease, maintain and operate works, with all appliances, patents and appurtenances necessary thereto, as now or may hereafter be used for the manufacture and production, supply and distribution of electricity for electric light, heat, power or any other purpose, and for the manufacture and production, supply and distribution of heat and power by steam or any other method in Hudson County.

"The principal object of the new company is to enlarge the electric facilities in Hoboken and North Hudson. The present concern has been supplying steam for power to several factories near its plant, as a matter of convenience, and a clause has been inserted in the articles of incorporation to include that function.

"Vice-President David Young of the North Jersey Street Railway Company is one of the incorporators, and Messrs. Hathaway and Waite of this city are two of the other incorporators. The remaining incorporators are interested in electric light companies in various cities. Some time ago the Hudson Electric Light Company was purchased by the General Electric Company and the new corporation is a branch of the parent company.

"The old concern has been supplying power to the North Hudson Railway Company for the operation of some of its trolley lines, but it is not expected that this will be materially increased. The company has also been supplying, and will continue to supply the North Jersey Street Railway Company with power."

Motor Cars for Army Use.

Motor cars are being tried in the autumn manœuvres by the German army. Should they prove efficient, a number will be manufactured by the Government and one or two attached to each regiment.

THE ELECTRIC CONSOLIDATION.

Mr. Westinghouse's Statement.

On the 21st inst. Mr. George Westinghouse, president of the Westinghouse Electric & Manufacturing Company, made the following announcement on behalf of his company:

"The election this day of Roswell P. Flower and Anthony N. Brady as members of the Board of Directors of the Westinghouse Electric & Manufacturing Company, to represent the interests of the former stockholders of the Walker Company, completes the union of the interests of the Walker Company of Cleveland with those of the Westinghouse Electric & Manufacturing Company. The purchase by the Westinghouse Company includes substantially all of the outstanding stock and all but $850,000 of the $2,500,000 of the twenty-year bonds of the Walker Company, the $850,000 remaining a first lien upon the property. The recent sale by the Westinghouse Company of $3,000,000 of debenture certificates has erroneously been connected with this transaction. The entire proceeds of the sale of these debenture certificates were used in retiring the floating and other debt of the company as previously announced.

"The increase in the total yearly fixed charges of the Westinghouse Company, due to the purchase of the Walker Company, will be but a little more than the sum that the Walker Company has been expending annually in defending patent litigation instituted by the General Electric and Westinghouse Companies. The acquisition of the Walker Company will, by reason of the agreement of March 31, 1896, between the General Electric and Westinghouse Companies, put an end to this patent litigation and very large annual expenditure on both sides. The business of the Walker Company, as a controlled company of the Westinghouse Company, will be entitled to the protection of the patents of the Westinghouse and General Electric Companies, and will in all respects be subject to the agreement between these two companies in relation to patents.

"The Westinghouse Company regards the business and good will of the Walker Company as a valuable acquisition, especially as the Walker Company brings with it upward of $1,250,000 unfilled orders. The Walker Company has at Cleveland modern and extensive works, equipped with machinery capable of manufacturing the largest types of railway apparatus, and will, with the works of the Westinghouse Company at East Pittsburg, constitute a manufacturing plant second to none in the country. The capacity and profits of the two companies will be increased by carefully harmonizing the manufacturing and selling operations, and the direct savings thereby effected should exceed the fixed charges incurred by the purchase of the Walker Company. The shipments of both companies, owing to the large orders on hand, have been increasing during the past few months and exceeded $750,000 for August.

"The total fixed charges of the Westinghouse Company, including those due to the Walker purchase and the dividends on its preferred stock, will be $42,000 per month."

The New Officers of the Edison Illuminating Companies' Association.

The nineteenth annual meeting of the Edison Illuminating Companies' Association, which was held at Sault Ste. Marie, Mich., was concluded on the 14th inst. It was one of the most successful and interesting meetings ever held by the Association. The following officers were elected for the ensuing year:

President—R. R. Bowker, New York.

Vice-President—G. R. Stetson, New Bedford.

Treasurer—W. S. Barstow, Brooklyn, N. Y.

Secretary—Wilson S. Howell, Newark, N. J.

Executive Committee—Samuel Insull, Chicago; J. W. Lieb, Jr., New York; C. L. Edgar, Boston; Alex. Dow, Detroit; J. H. Vail, Philadelphia.

CANADIAN NOTES.

The Montmorenci Power Company of Quebec has been taken over by the Quebec, Charlevoix & Montmorenci Railway, which also owns the Quebec Electric Street Railway. Each original owner of stock in the Power Company, which furnishes light to the city and power for the electric road, receives an equal amount of stock in the new amalgamated company and the same amount of 5 per cent. debentures, redeemable in twenty years.

The hearing of evidence in the big electrical fight between the Royal Electric Company and the Lachine Rapids Hydraulic Company is now being taken before Judge Taschereau at Montreal, and promises to last some time. The Royal Electric started the ball rolling by first taking out an action for $5,000 against the Lachine company for general injury to their business by interfering with their circuit by crossing of wires and cutting the same, erection of poles, etc. This original demand was supplemented by an incidental demand of $50,000 for additional and sustained damages. The Lachine company took out a counter action for $105,000 damages to their business and for the circulation of injurious rumors that the Lachine company was suffering from the ice and that they would be unable to carry out their contracts and other injurious stories. These rumors, it is claimed, were of a nature to discredit and injure the company in the eyes of the community.

At the Montreal Royal Electric Company's annual meeting, the reports presented were considered to be satisfactory. The gross revenue was shown to have been $955,826, expenditure $636,057, interest and fixed charges $42,609, net profit $277,160. Four quarterly dividends have been declared of 2 per cent. each, equalling $120,000. Ninety thousand dollars were charged to profit and loss for reduction of assets in patents, $25,000 for depreciation of plant, and $31,992 for other reasons. It was shown that the company last year made 18½ per cent. on invested capital. A dividend of 8 per cent. has been paid yearly since 1891.

Since the commercial utility of electricity has been established, Canada has reason to congratulate herself on the enormous water powers available within her borders for transmission into manufacturing power. The falls of the Kootenay river, B. C., are the latest to be put in harness. The scheme contemplates the ultimate using of these falls, giving a capacity of 60,000 horse power, the present development on the middle fall (there being three falls known as the Bennington Falls) is 20,000 horse power. An interesting point that this work has demonstrated is that electrical energy may successfully be transmitted a distance of 30 miles. Almost simultaneously with the starting up of this plant the Cataract Power Company of Hamilton, Ont., under a generated pressure of 22,500 volts, carried a current to a transformer station 35 miles distant, for distribution.

Opening of the Y. M. C. A. Educational Classes.

At this time of the year many young men who are engaged in business in the daytime are making their plans to study in evening schools. These are the young men who think, and think to a purpose, and are advanced in business by reason of their increased value to their employers.

The Young Men's Christian Association conducts evening classes in commercial, scientific and language courses. At the West Side Branch of the Association, 318 West 57th street, New York, the opening exercises of the Educational Classes will be held in the auditorium on Monday evening, October 3, at 8:15 o'clock. Rev. J. M. Buckley, D. D, editor of the N. Y. *Christian Advocate*, will make the address of the evening, and music will be furnished by the Orpheus Mandolin & Guitar Club and Mr. J. Armour Galloway.

The West Side Branch is the most modern and best equipped building for Association work in this

country, and on the above evening all its rooms will be open to visitors.

Further information may be obtained of the secretary, Dr. D. E. Yarnell, 318 West 57th street.

Verdict of the Coroner's Jury in the Cohoes Collision Case.

The verdict rendered by the coroner's jury with respect to the casualty at Cohoes, N. Y., on Labor Day, when many persons were killed and many more injured by the collision of a railroad train with a motor car, is considered to be a just one and entirely consistent with the facts. They find that the Delaware & Hudson Canal Company's train was being propelled at a rate of about forty miles per hour in violation of a city ordinance; that the city had requested the D. & H. Company to place gates at the crossing, but the request had never been complied with. For this the company is censured, and demand is made that the city of Cohoes cause the arrest and punishment of the conductor and engineer of said train and that the company shall enforce in future the limit to the rate of speed; request is made that the Mayor and commonalty do all in their power to abolish grade crossings and in the meantime use gates. It is further found that the accident was caused by the criminal negligence of the motorman on the trolley car for not ascertaining whether or not a train was in sight before attempting to cross the tracks. The Troy City Railroad is severely censured for removing the demolished car, thus making it impossible to determine the condition of the brake at the time of the accident. It is also recommended that the Member of Assembly and the Senator from the district be requested to introduce into the Legislature at its next session a bill providing that a wreck in which life is lost shall remain until examined by properly authorized persons.

In accordance with these findings the engineer and conductor of the D. & H. train at the time of the accident were arrested and arraigned; both plead not guilty and were released upon their own recognizances for examination October 1. The conductor on the motor car has also been arrested but is now on bail, the bond being for $2,500. The motorman is still in too serious a condition to be taken from his home. Many suits have been commenced against the D. & H. and the Troy City Railroad by the relatives of those killed and injured at the time of the collision.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILWAYS.

Albany, N. Y.—The Railroad Commissioners have granted the application of the New York & North Shore Railway Company for permission to construct an electric road from the terminus of the New York & Queens County Railroad, at Middle Village, L. I., through Jamaica, Flushing, Whitestone, College Point and Bay Side to Manhasset.

Americus, Ga.—There is a movement here looking to the building of an electric street railway. Plans and estimates for a belt line about five miles long have been made by a local engineer, but no organization has been effected yet.

Cranford, N. J.—The council has granted a franchise to the Westfield & Elizabeth Railroad Company to build a trolley road through the town. The company now has franchises for every foot of the distance from Elizabeth to Plainfield except through Roselle.

Denver, Col.—The board of supervisors, to which ordinances granting franchises are submitted for approval, have refused to confirm the franchise for a change of motive power granted the cable railway company which was passed over the mayor's veto by the board of aldermen.

Doylestown, Pa.—The Newtown Electric Street Railroad Company, which recently acquired control of the Langhorne & Bristol trolley road, has awarded the contract for the extension of this line from Newtown to Doylestown. This will make a continuous line of 26 miles from Bristol to the county seat.

Hartford, Conn.—The company organized recently under the Suffield & East Granby Street Railway charter intends to petition the Superior Court to have the name changed to the Hartford & Springfield Street Railway Company. George W. Dunham of Flemington, N. J., is president of the new company and the directors besides him are E. R. Gilman of New York, Noble E. Pierce and F. L. Fairbanks of Bristol and T. F. Welsh of Southington, Conn. Mr. Dunham organized the company for the completion of the road begun by Jesse W. Starr and others. Mr. Starr, who has a grievance against Mr. Dunham, has organized a rival company to be known as the West Springfield & Agawam Company and published notice that he would apply for a franchise. The route planned for this road is from the old toll bridge in West Springfield, down Bridge street and out to the Agawam river, over which a bridge is to be built, and thence to Agawam, Feeding Hills and Mittineague by branch lines. The capital stock of the West Springfield & Agawam Company is $100,000.

Houston, Tex.—A fifty-year franchise for an electric railroad in this city has been granted to J. C. Ward, E. L. Bacon and their associates, all of whom are stockholders in the electric light company.

Hudson, N. Y.—An extension of the Hudson street railway to Philmont is contemplated. Engineers and contractors have been looking over the route.

Lewiston, Me.—The railroad commissioners have issued a certificate to the Lewiston, Brunswick & Bath Street Railway Company for the operation of that section of the road between Lewiston and Topsham, a distance of 18.75 miles. This completes the certificates that will have to be issued to the road, as the whole of it is now in operation. The entire road comprises a distance of a little over 45 miles.

Montreal, Can.—One of the car sheds of the Montreal Street Railway Company was destroyed by fire on the 16th inst. The damage amounts to about $150,000. There were inside of the shed 68 cars, 28 closed cars and 20 that were under way. There were some thirty motors in the shed valued at $50,000. They were all destroyed. Seven sweepers were completely destroyed. Only six cars in the shed were saved. The property destroyed was insured for $90,000.

Newport, R. I.—The Boston "Gazette" states that the gross earnings of the Newport & Fall River Street Railway Company, which is largely owned by Boston people, from June 19—when it commenced operations—to August 31, were $27,462, and the net $14,327. The interest requirements for a full year are $12,000, so that already in 73 days the road has earned its fixed charges and $2,327 besides.

Oswego, N. Y.—There is now under consideration the project of a trolley line from Syracuse to this city as an extension of the Lakeside road from Baldwinsville, Phoenix, Fulton and Oswego Falls. Receiver Tidman of the Lake Ontario and Riverside road of Oswego will bring plans for the proposed extension before the Lakeside directors in a few days.

Pine Bluff, Ark.—Work has been begun on the new electric car line which is to be established here, in connection with an electric light plant, by Indiana capitalists.

Portland, Me.—There is talk here of building an electric railway around Long Island in Casco Bay. The island is capable of being easily transformed into an attractive summer resort and a street railway is considered an essential feature of such a scheme.

Richmond, Ind.—Dayton (O.) capitalists have been looking over three proposed routes for an electric line between Eaton, O., and this city. Dr. J. E. Lowe, who is connected with the Dayton and Eaton line, now in successful operation, is at the head of the new enterprise. He estimates the cost at $400,000, and says the line will be as good as any in America. The survey of the chosen route will begin immediately.

San Francisco.—The Market Street Railway Company intends to convert the steam railway running from California street to the Cliff into an electric line. It is stated that the new electric line south of the park has proved a success beyond the anticipations of the directors. The old dummy line was for years operated at a loss. The new line has not only paid the cost of operation but has paid interest on the cost of construction as well.

Wabash, Ind.—The owners of the South Bend system are reported to have purchased the Indiana Electric Company's line connecting Elkhart with Goshen. The new owners, it is said, will build a trolley line from South Bend to Goshen this fall.

Watertown, N. Y.—The Black River Traction Company is negotiating for a water privilege on the Black river in this city with the purpose of erecting a power plant for the production of electricity for use in the operation of its railway system.

Wichita, Kan.—It turns out that the money was behind the bond for $10,000 tendered by H. B. Church as a guarantee that he would build and equip a first-class street railway and electric light plant in this city. On the evening of the 13th inst., Joseph O. Burdett of Boston appeared in the council chamber, and was loudly cheered as he walked up to the city clerk's table, in front of Mayor Ross, and counted out ten thousand dollars in crisp new bills, good and lawful money of the United States, and said he was ready to pay it over the moment the franchise asked for by Mr. Church was passed and approved by the mayor. A franchise was at once drawn up by the city attorney, passed by the council and signed by the mayor, and ten one thousand dollar bills were immediately handed over to the cashier of the Fourth National Bank, in which the city funds are kept, who, guarded by the assistant chief of police and the city treasurer, took it to the bank. In the franchise Mr. Church's company is named the Wichita Railway, Light & Power Company.

Woonsocket, R. I.—The "Call" states that work will be begun in a few months on the new electric road that is to connect Attleboro with Boston by the way of Franklin and South Framingham. The new line will connect with the Inter-State Consolidated road at Plainville and extend through Wrentham by Lake Pearl along the Creek road to Franklin, and will be 20 miles in length. This will be the connecting link between Providence and Boston in that direction. The promoters include George W. Wiggin, Joseph G. Ray, Edgar K. Ray, Edward H. Rathburn, Charles W. Shippee, William S. Reed, William H. Tyler and O. T. Doe. The new system will be known as the Milford, Attleboro & Woonsocket Street Railway Company.

Wrentham, Mass.—The selectmen have granted the Milford, Attleboro & Worcester Street Railway Company the right to operate a street railway through Wrentham.

LIGHTING.

Birmingham, Ala.—A new electric light plant will be set up at Ensley City to furnish light to the steel mill and the furnaces. Work will be begun on the plant on the 1st of November. The estimated cost is $20,000.

Bridgeport, Conn.—The electric light plant at Pleasure Beach was destroyed by fire on the 19th inst. The loss is estimated at between $7,000 and $8,000.

Cape May, N. J.—The court has appointed Joseph Q. Williams receiver for the Franklin Electric Light Company here, and by his orders the city is again illuminated.

Camden, N. J.—The lighting committee of the city council has instructed the city clerk to communicate with municipalities operating their own electric lighting plants and ascertain the cost of building and maintaining them. The committee, however, also decided to advertise for bids for lighting the city with electricity for one, three and five years. The present contract expires next June.

Crescent City, Fla.—Two applications have been made to the town council for an electric lighting franchise. The applicants were C. H. Cash of Miller & Cash, city water works, and W. J. Pierpont of the Pierpont Manufacturing Company. The applications were laid over for one month for consideration.

Greensboro, N. C.—The Industrial & Immigration Society of this city has passed a resolution in which the board of aldermen is urged not to enter into any contract for lighting the streets "until every possible effort shall have been made to secure an electric system that shall furnish to the city: street lights; incandescent lights for stores, offices and residences; convenient electric power for small manufacturing enterprises, and a street car system." The aldermen have taken up the matter for consideration.

Hudson, N. Y.—Charles J. Cooper of Brooklyn, who recently purchased the Hudson street railway, has just closed negotiations by which he also becomes sole owner of the plant and franchise of the Hudson Electric Light & Power Company.

Kansas City, Mo.—Electricians have begun the work of stringing wires for the carnival illuminations which will be this year more beautiful and elaborate than ever. Among the displays will be electric fountains and arches, and it is intended to make the whole city a blaze of light. The carnival week begins October 2.

Manheim, Pa.—F. E. Bailey & Co., for the Manheim Electric Light, Heat & Power Company, have secured the franchise for lighting the streets of Mt. Joy. The distance from Manheim to Mt. Joy is about seven miles and the line connecting the two places will be erected at once. Water and steam power have been and will continue to be used on an enlarged scale in the plant at Manheim, which, with the improvements now in course of construction, will make it an important electric light station. Incandescent lamps will be used in the streets of Mt. Joy.

New Orleans.—The "Picayune" of the 18th inst. says: "The ordinance permitting Cohn & Ber to build and operate an electric plant for the manufacture of light and power has been promulgated, and this places three franchises of this character in the hands of local people. If all three are established there will be active competition for the lighting of the city provided that the franchise committee holds up the ordinance to advertise the lighting of the city, now in their hands."

Orangeburg, S. C.—An election is called for the 27th inst. to vote on an issue of $40,000 worth of bonds for the erection of waterworks and an electric light plant.

Philadelphia.—Frank M. Riter, director of the Department of Public Safety, advertises for proposals for furnishing electric arc lights for the city for the year 1899, bids to be received until October 4. All bids must be made upon printed blanks to be furnished by the department, and accompanied by a certified check to the order of the city treasurer for $5,000.

Pittsburg, Pa.—On account of the unparalleled electrical illumination which is to be provided to do honor to the Knights Templars who are to meet in conclave here during the week beginning October 8, a host

of electrical experts are expected in the city. It is estimated now that fully 400,000 lamps will be used, and half of these will be colored. One of the great centers of illumination will be the ball room, which is capacious enough to hold 25,000 people and will be lighted with all the splendor that artistic disposition of arc and incandescent lamps is capable of dispensing.

Pratt City, Ala.—Paschal G. Shook and associates have been granted a franchise for an electric light plant in this city.

Somerville, Tenn.—An electric light plant to cost $10,000 is to be established here.

Rawlins, Wyo.—The electric light plant of this place has been purchased by J. A. Rendel, who will resign his position in the First National Bank and devote his entire time to the management of the electric light business.

Wooster, Ia.—An election is to be held here on November 8 to get the public vote on the question of issuing bonds for an electric light plant.

MANUFACTURING, ETC.

Kalamazoo, Mich.—A factory for the manufacture of trolley wheels under a new patent is to be established here immediately. The company has a capital of $10,000.

St. Louis.—A car company in this city has received an order from Japan for 250 street cars to cost $300,000 and to be delivered within ninety days.

Washington, D. C.—The Navy Department, through the Bureau of Yards and Docks, is inviting sealed proposals until October 15, 1898, for installing an electric light and power plant at the United States Naval Station, Puget Sound, Bremerton, Washington. The appropriation for the work is $9,800. Prospective bidders desiring specifications and details of the work can obtain the same upon application to the chief of the Bureau of Yards and Docks, Washington, D. C., or to the commandant of the Naval Station at Bremerton, Washington.

TRANSMISSION PLANTS.

Columbia, Pa.—There is a fair prospect now of the immediate repairing of the dam on the Susquehanna river near Wrightsville for the Martic Water & Power Company as the bids are all in. On October 10 proposals will be received for 24 turbine water wheels and necessary shafting. It was the company's first intention to build its power house on the rocks below the dam, but it is now said that the house will be erected on Mud Island, about half a mile from the dam, and fed by a tail race. The latter will be constructed on the York county side. The company will furnish electricity for lighting and power to towns and manufactories in the neighborhood.

Lowville, N. Y.—The Wetmore Electric Company is at present securing the right of way from Belfort to Lowville by air line, instead of following the highway, and in this way will shorten the distance about 3 miles, making the total distance a little over 11 miles. The company will commence setting poles and stringing wires in a few days. A large number of men are at work on the raceway at Belfort. Provision is being made at the Beaver river falls for placing three dynamos of 230 HP. each. The plant will be operated continuously day and night, so that electricity can be used for lighting or power at any time.

Montpelier, Vt.—The Bolton Falls water power privilege has been secured by the Consolidated Electric Lighting & Power Company, who have awarded a contract to W. H. Ward & Co., of Lowell, Mass., for the building of a dam and power house at that place. Generators of an improved pattern will be put in, and it is the intention of the company to furnish electricity for heating, lighting and power to this city and to Barre, Waterbury and Stowe. The company expect to have about 2,000 horse-power for sale beyond what they need for their own uses.

COMPANY MATTERS.

Boston.—The Continental Construction Company, whose incorporation has just been completed, has secured a handsome suite of offices at 170 Summer street. The "Traveller" says of the company: "The management is in the hands of parties with large experience both in machinery and in the building and equipment of electric railways and electric light and power stations, which two lines of electrical application will constitute the main outlets for the business push of the concern. Ample capital has been secured, and the charter of the corporation is broad enough to permit the handling of almost any enterprise that offers a fair show for profit. The company now controls the franchises of several electric railways which are to be built in the near future, work on some of which will be well advanced this autumn. The manager announces that there is business enough in sight to absorb all its energy for perhaps a year to come. It thus enters the field full-fledged and with every prospect of a successful career."

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—In the inquest into the death of John McGraw, who was electrocuted, about two weeks ago, while working on the electric wires of the Albany Railway, it was decided by the coroner's jury that deceased had met his death through his own neglect. The fact that he wore no rubber gloves was an important point in the opinion of the jurors.

Burlington, Vt.—The mayor has signed the resolution giving use of the river road to the Burlington Traction Company.

Fonda, N. Y.—The Cayadutta Generating Company have purchased the electric plant of the Streeter Brothers and state that they will now furnish light cheaper than ever. They have fine water power at Berryville for the purpose, and will soon be in active operation.

PERSONAL AND MISCELLANEA.

A. L. Gillette, recently electrician of the Terre Haute Electric Railway Company, has been appointed superintendent of the electrical department of the Marinette (Wis.) Light & Power Company.

A London dispatch states that the first section of the electric railway to the summit of Jungfrau, the famous mountain of the Swiss Alps, has been opened as far as the Aasiger glacier, and it is expected the road will be finished by the year 1904.

City Electrical Engineer Jacques Morgan has planned an electrical steam fountain, situated on the roof of a prominent building in Kansas City, Mo., for throwing many colored jets of steam high into the air during Carnival week. This feature is an entirely new one, and it is said that a much more beautiful effect can be obtained with steam than with water, which has generally been used in displays of this kind.

The San Francisco "Examiner" of the 15th inst. says: "A new motor car was operated yesterday on the California street cable railway route. The inventor of the new motor is John Ryder of this city. The motive power is a secret composition that resembles gasoline. The car is intended to be operated only where grades are slight. The inventor says he can run a car at a cost of $1 a day. The invention on this first trial appeared to be successful."

A letter from Manila, received at San Francisco, tells of the brave conduct of E. E. Kelly of the Signal Corps during the engagements before the Philippine capital. In the heat of the conflict he carried a wire a mile and a half right into the Spanish intrenchments while the bullets fell around him like hail. Two comrades fell alongside of him, one fatally wounded. For his bravery he was made first sergeant. Gen. Merritt has sent his name to President McKinley, recommending recognition of his "gallant and meritorious conduct during the capture of Manila," and it is expected that he will at least get a Congressional medal.

A new signaling device to aid ships at sea to converse with one another at long distances has been invented by John W. Haywood of St. John's, N. F. The new machine is an adaptation of the magic lantern principle. The lantern is a powerful one and is supplied with a battery on stenciled plates containing the letters of the alphabet. These plates are connected by a series of levers with a keyboard, much the same as in a typewriter. The keys are marked with the letters and pivoted in such a way that when one presses down on one of the keys the corresponding slide is drawn up in front of the lens, and the letter is thus thrown out vastly enlarged. The lantern makes it possible to throw a series of letters in dazzling light upon a sail, a house or upon the clouds, so that they may be seen readily for a distance of several miles. The keyboard attachment enables the operator to project these letters so quickly that a long signal may be spelled out almost as quickly as it could be written on a typewriter. The scheme may be used either in the merchant marine or on warships or from lighthouses. It admits of a cipher being used for secret messages and is adaptable to any language. The device has already been tried with gratifying success on a warship.

RECENT COMPANY ELECTIONS.

Cayadutta Electric Railroad Company, Gloversville, N. Y.—Directors: J. H. Decker, Harwood Dudley, Thos. E. Ricketts, J. Ledlie Hees, George M. Place, A. J. Zimmer, Gustav Levor, Samuel H. Shotwell, Robert T. McKeever, John G. Ferres, G. W. Judson, Z. B. Whitney and E. C. Shotwell.

Denver Consolidated Tramway Company, Denver, Col. —President, Rodney Curtis; secretary, W. G. Evans; superintendent, C. K. Durbin; directors: the officers and George E. Ross-Lewin, Samuel H. Elbert, Frank Trumbull, James H. Blood, W. N. Byers, C. F. Musgrove, S. M. Perry, Thomas Keeley, W. F. McClelland and N. O. Jelliff.

Mount Holly Electric Light Company, Mt. Holly, N. J.—President, Amos Gibbs; secretary and treasurer, Samuel A. Atkinson; directors: Amos Gibbs, Benjamin F. Lee, James L. Jamison, Robert L. Nixon, Dr. Parsons, Joseph C. Cowgill, Samuel Atkinson and Edward D. Stokes.

Worcester Electric Light Company, Worcester, Mass.—President, Thomas M. Rogers; clerk and treasurer, Herbert H. Fairbanks; superintendent, William H. Coughlin; directors: Thomas M. Rogers, Stephen Salisbury, Loring Coes, Gen. A. B. R. Sprague, N. S. Liscomb, Theodore C. Bates and Gen. Josiah Pickett.

COMMERCIAL PARAGRAPHS.

The Ludewig-Thurber Manufacturing Company, 565 Old avenue, Pittsburg, Pa., beg to announce that having removed to more commodious quarters and having their shop more fully equipped with modern machinery they are better prepared to handle all classes of electrical repair work than heretofore. This well known concern is giving special attention to armature and field winding, refilling of commutators, etc., and is now ready to quote prices consistent with first-class work. The firm also buys and sells motors, generators and other apparatus of similar nature.

The attention of our readers is directed to the advertisement of Thomas A. Edison, Jr., which appears elsewhere in this issue. The Edison Junior "Improved" Incandescent Lamps are now so well known that a detailed description of their many advantages and good points would be superfluous. As will be recalled, this make of lamp attracted considerable attention and drew forth many favorable comments by its brilliancy at the Electrical Exposition in May last. These lamps are manufactured at Shelby, Ohio, while the general offices and salesrooms are located at 27 William street, New York City. With a view to giving one an idea of how extensively these lamps are being used, it is only necessary to state that Mr. Edison, Jr., has found it advisable to establish branch offices at 60 State street, Boston, at St. Paul, Minn., at Los Angeles, Cal., at Norfolk, Va., at Austin, Tex., and at Santiago de Cuba.

The Electric Appliance Company, Chicago, have just printed a special catalogue devoted exclusively to Anchor switches. This catalogue is fully up to date, embodying all the recent improvements that have been made in snap switches. The catalogue is supplied with a special discount sheet to the trade and altogether makes a valuable little reference book on switches. It can be had for the asking.

"Helps in Brazing."

The Dixon Crucible Company of Jersey City, N. J., has published a little pamphlet with this heading. It treats incidentally of brazing graphite, the application of which to bicycle tubes prevents the adherence of the spelter and so effects a saving in labor by making unnecessary the filing which is otherwise needful. The pamphlet, however, especially treats of the process of brazing by the dipping method, or "liquid brazing," as it is called. The brazing crucible is described, together with instruction and caution in regard to its use. Instructions are given how to build and set the necessary furnace, time required for brazing, etc., etc.

In regard to the economy of liquid brazing as against the old-time fire brazing, the following is quoted from a well-known bicycle manufacturer:

"We have been using the process of liquid brazing all this season, but at first found some difficulty in keeping the spelter at the proper temperature. We built several furnaces before we succeeded in getting one entirely successful. The one we have now in operation enables us to do as much work with one man and a boy as we were able to do before with five to seven men, and the results are much more satisfactory. We figure that we effect a saving of $20 per day every day we run the new furnace. Besides requiring fewer workmen, we use only about 125 pounds of hard coal in a day's run, which is quite a contrast to the expense we were under with the old gas furnace, when our gas bills amounted to $250 per month. With the new process one man and a boy can turn out seventy-five machines in a run of seven hours."

The pamphlet is of interest to all bicycle manufacturers and others who do brazing. It is sent free of charge.

INCORPORATIONS.

The Lancaster & Jefferson Electric Light Company, Lancaster, N. H. Capital stock, $36,000.

The City of Lincoln Gas Company, Chicago—to furnish gas and electricity to the city of Lincoln, Ill. Capital stock, $10,000.

The Dowd Electrical Company, Albany, N. Y. Capital stock, $100,000. Incorporators: Henry Fitch, Pepperell, Mass., and others.

The Empire Heating & Lighting Company, St. Louis. Capital stock, $5,000, all paid. Incorporators: S. L. Cohen, John Costello and J. C. Robertson.

The Electric Connecting Railway Company, St. Louis—to operate a street railway in St. Louis and Jefferson Counties. Capital stock, $2,000. Incorporators: M. T. Chestnut, John H. Bobring and James D. Houseman, Jr.

The Standard Light & Heat Company, Philadelphia (incorporated in West Virginia). Capital stock subscribed $100, with privilege of increasing to $1,000,000. Incorporators: R. Miles Robinson, William L. Teter, E. O. Wharton and Henry Robinson, Philadelphia; Joseph W. Irwin, Govanstown, Md.

The Safety Third Rail Electric Company, New York—to supply electricity and deal in goods, etc., pertaining to electricity. Capital stock, $1,000,000. Directors: Emerson McMillin, Emerson McMillin, Jr., W. F. Douthitt, C. T. Scoville, R. H. Beach, William M. Keepers, David F. Halsted, John McLeod Murphy and Louis Steckler, of New York City.

The Potosi & Rio Verde Railway Company, New York City—to construct a steam or electric road 66 miles long in the State of San Luis Potosi, Mexico. Directors: Robert S. Towne, George Foster Peabody, Edward M. Shepard, A. Foster Higgins, Charles J. Nourse, Jr., Herbert H. Dean, Samuel H. Ordway and Francis N. Holbrook, of New York City, and Donald O. Brown, of San Luis Potosi.

ELECTRICAL PATENT RECORD.

Letters Patent Issued September 20, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

610,891. Electric-Railway-Car Truck. George J. Capewell, Hartford, Conn. Filed June 14, 1898.

610,927. Trolley. Olof W. Swanson, Tacoma, Wash. Filed Sept. 18, 1897.

610,982. Electric Locomotive. William S. G. Baker, Baltimore, Md. Filed Nov. 24, 1894.

610,999. Electric Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed March 18, 1895.

611,000. Electric Coupling. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed Jan. 9, 1896.

611,001. Electric-Heating System. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed July 6, 1896.

611,053. Electric-Railway Construction. William Chapman and Percy W. Davies, Pittsburg, Pa. Filed Nov. 23, 1897.

610,915. Fender or Guard for Cars. Peter J. Poelman, New Orleans, La., assignor of one-half to Chris Jacob, same place. Filed May 18, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

610,898. Electric-Arc Lamp. Max Harris, New York City, assignor to the Manhattan General Construction Company of New York. Filed Oct. 27, 1897

611,162. Electric-Arc Lamp. Frederic S. Worsley, London, England, assignor to the British Blahnik Arc Light Company, Limited, same place. Filed March 15, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

610,887. Automatic Circuit-Breaking Switch. William F. Bossert and William D. Pomeroy, Utica, N. Y., assignors to the Bossert Electric Construction Company, same place. Filed July 12, 1897.

610,895. Controller for Electric Motors. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 2, 1898.

610,899. Electric Meter, Caryl D. Haskins, Newton, Mass., assignor to the General Electric Company of New York. Filed June 24, 1898.

610,903. Circuit-Breaker for Three-Wire Systems. Edward M. Hewlett, Schenectady, N.Y., assignor to the General Electric Company of New York. Filed Sept. 7, 1897.

610,904. Safety Device for Dynamo-Electric Machines. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed April 4, 1898.

610,908. Electric Brake. John B. Linn, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Jan. 7, 1898.

611,006. Combined Generator and Steam-Engine. Marey L. Whitfield, Memphis, Tenn., assignor to the American Dynamo Engine & Motor Lamp Company of Tennessee. Filed Nov. 16, 1897.

611,087. Contact Finger for Controllers or Electric Switches. Thorsten von Zweigbergk, Cleveland, O., assignor to the Walker Company, same place. Filed Feb. 23, 1898.

611,088. Governing, Reversing and Braking Controller. Thorsten von Zweigbergk, Cleveland, O, assignor to the Walker Company, same place. Filed Feb. 23, 1898.

611,089. Method of and Means for Controlling and Cutting Out Electric Motors. Thorsten von Zweigbergk, Cleveland, O., assignor to the Walker Company, same place. Filed April 29, 1898.

611,090. Controller. Thorsten von Zweigbergk, Cleveland, O., assignor to the Walker Company, same place. Filed April 29, 1898.

611,151. System of Electrical Distribution. Charles F. Scott, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed Oct. 22, 1897.

611,205. Circuit-Interrupting Device. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York City. Filed July 3, 1897.

611,215. Electric Controller. Samuel Harris, Twinsburg, O., assignor to the Steel Motor Company of Ohio. Filed May 2, 1898.

BATTERIES.

611,012. Electric Battery. Victor Jeanty, Paris, France. Filed Oct. 21, 1897.

611,175 Galvanic Element. Robert Krayn and Carl Koenig, Berlin, Germany; said Krayn assignor to said Koenig. Filed June 19, 1897.

MISCELLANEOUS.

610,907. Apparatus for Electroplating Articles in Bulk. Georg Langbein, Leipsic, Germany. Filed Jan. 22, 1898.

610,928. Electrostatic Measuring Instrument. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company of New York. Filed March 27, 1897.

611,100. Electroplating Apparatus. Hermann B. Boissier, New York City. Filed Jan. 14, 1898.

611,142. Electric Furnace. Riccardo Pignotti, Ferdinando Lori, Scipione Regnoli, Marco Besso and Maffeo Pantaleoni, Rome, Italy. Filed June 27, 1896.

611,148. Apparatus for Electrically Coating Wire. William S. Rawson, London, England. Filed Dec. 24, 1897.

611,185. Rheostat. Charles H. Richardson and Lewis McMakin, Jr., Philadelphia, Pa., assignors to the S. S. White Dental Manufacturing Company, same place. Filed Feb. 3, 1898.

DESIGNS.

29,366, 29,367, 29,368, 29,369. Electric Lamps. George R. MacIntire, New York City, assignor of one-half to Elliott P. Gleason, same place. Filed March 18, 1898.

29,370, 29,371. Lightning-Arrester. Herbert C. Wirt, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Aug. 29, 1898.

29,372. Field-Magnet Frame. Edward D. Priest, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Aug. 26, 1898.

29,373. Casing for Dynamo-Electric Machines. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Aug. 8, 1898.

29,374. Motor and Fan Case. Herbert A. Balcome, Boston, Mass. Filed Aug. 18, 1898.

29,375. Frame for Generating Sets. Fritz Handel, Boston, Mass. Filed Aug. 18, 1898.

TELEPHONE AND TELEGRAPH.

The telephone situation in Washington, D. C., is rather tantalizing to users. By an act of Congress it is "unlawful for any person or any telephone company doing business in Washington to charge or receive more than $50 per annum for the use of a telephone on a separate wire; $40 for a telephone there not being more than two on a wire; $30 for each telephone there being not more than three on a wire, and $25 for each telephone there being four or more on the same wire." The telephone company, holding that the law is unconstitutional, refused to comply with its provisions when patrons endeavored to take advantage of it, and the result has been a series of suits in which the local judges have invariably decided against the company, but the latter has determined to carry the matter to a higher court, and any injunctions issued against it are in a measure rendered void. Those using telephones are required to give surety to secure the company against loss in the event the Supreme Court shall decide the act unconstitutional, and even under the restrictions of a restraining order already issued by Justice Hagner, a new subscriber would be able to procure the service of a telephone for $50, but by using its privilege of appeal the telephone company can avoid furnishing the service unless the proposed patron pays its established rate of $125 for the use of an instrument within a distance of a mile of the central office, and the graduated scale of prices adopted by the company and in force long before Congress enacted any legislation upon the subject.

A press dispatch from Minneapolis, Minn., dated September 20, says: "Negotiations which have been pending some time were closed to-day whereby the Northwestern Telephone Exchange Company, the Western Electric system, the Western Electric Telephone Company, the Minnesota Mutual Telephone & Telegraph Company, and all of the dependent and allied companies, operating in between 500 and 600 towns, will pool issues and operate their lines in direct connection. This will make it possible to reach about 8,000 miles from Minneapolis by wire, and enable the city to talk with all parts of Iowa, Nebraska, Missouri, Kansas, Illinois, and in fact as far as electricity will carry the voice."

The Topeka, Kan., *Journal* says there is a telephone war on in Atchison. Some time ago a company was organized and secured a franchise to give Atchison a second company. Poles are now being set, and the new company will be ready for business within 60 days, and will furnish business telephones at $2 a month and residence telephones at $1 a month, a considerable reduction from the prices the old company has been charging. Last week the old company—the Missouri & Kansas—put four solicitors at work making contracts for residence telephones at 75 cents a month and business telephones at $1.50 per month.

The Baltimore & Ohio Railroad Company is about to experiment in using the telephone for long distance communication. Work will begin in a few days on the construction of two new copper telegraph lines between Baltimore and Pittsburg, 340 miles, and they will be so arranged that when the necessity arises they will be available for telephonic communication. One of the wires will be extended as far as Newark for telegraphic use. A new line has also been constructed between Columbus and Cincinnati. It will take 800 miles of copper wire, weighing 166 pounds to the mile, to complete the work.

The Albemarle Telephone Company at Charlottesville, Va., has elected the following officers: President, J. Edwin Wood; vice-president, James F. Hardin; directors: John B. Moon, J. M. Robinson, Phil Leterman, J. B. Andrews, M. Kaufman, W. J. Tyson and S. C. Chancellor. The president reports 416 'phones now in operation, and that the system has been extended to many important points twenty-five miles distant from the city. Arrangements are being perfected by which the line will in the near future be extended to Staunton, Lynchburg, Orange Court House and other cities.

Sartaro Oi of the Department of Telegraph and T. S. Horiye of the Department of Industries, of Japan, were in Chicago a few days ago inspecting the telegraph and telephone systems. "Our visit is of a semi-official nature," said Mr. Oi, "and relates to the proposed extension of our telegraphic communication system. We have 50,000 miles of telegraph wires in the empire, and nearly that amount of telephone wires, but we propose to extend this system so that it will include every settlement of any size in the country."

A correspondent of the St. Paul *Dispatch* at Aberdeen, S. D., states that the management of the Dakota Central Telephone Company are very much disappointed over the Bell Company having absorbed the Minnesota Central system. It was expected that a rate of 75 cents for a five-minute talk could be arranged between the two companies, but the Bell Company has raised the rate to $2.25, out of which the Dakota line gets 25 cents.

The Volunteer Signal Corps.

General Greely has issued an order relieving from duty, preparatory to muster out, the Volunteer Signal Corps. He says he cannot permit the men to return to private life without acknowledging their "loyal, efficient and valuable services to the nation." In reciting the services rendered by the corps in Santiago and Porto Rico he says:

"In the Santiago campaign you were the first of the army to arrive, as you were the last to leave. Destroying within range of Spanish guns the submarine cables that gave the enemy daily information of inestimable value, when the occupation of Santiago was ordered you repaired cables with such celerity that you opened communication between the United States marine camp at Caimanera (Guantanamo) and New York City on June 21, the day prior to the landing of the Fifth Army Corps off Santiago. Owing to your efforts, the American army in Cuba has not been isolated telegraphically a single day.

"In the Cuban campaign you arranged, maintained and operated a system of cable and land lines—partly commercial, partly war cables, partly flying telegraph lines and partly telephone lines—that enabled messages to pass in twenty minutes from the Executive Mansion in Washington to the headquarters of the army before Santiago, and which offered direct and immediate communication between the Secretary of War in his office and the Signal Corps men in the advanced rifle pits on the right, the left and in the center of our intrenched army, within 400 yards of the enemy. When the city fell your lines followed immediately army headquarters as it moved therein.

"No one will ever know the difficulties—physical and moral, climatic and service—under which you labored in Cuba. Heat and thirst, hunger and fatigue—these present sufferings, with impending disease and death, you endured and faced uncomplainingly with the rest of the army; but these conditions never prevented the prompt, cheerful and efficient discharge of the important duties devolving unremittingly day and night upon the Signal Corps.

"In Porto Rico you were with the advance, participating as scouts and skirmishers in the capture and occupation of towns. From the beginning to the end of the campaign you kept each important command in telegraphic or telephonic communication, both with the corps commanders and also with the base of operations.

"The Signal Corps has filled neither the guard house nor the hospital. Serving in the field in Cuba, in Porto Rico, in the Philippines, and in home garrisons at Tampa, Chickamauga, Camp Alger, Jacksonville and Montauk, yet your total aggregate of over thirteen hundred has lost by disease in camp and field to date only five—officers and men included."

General Manager H. J. Hanford of the Kinloch Telephone Company, St. Louis, says the service of the company will be put in operation October 1. The testing of the connections of the switchboard are about complete. The telephone boxes of the company have been distributed and it has between 4,000 and 5,000 subscribers.

The stockholders of the Tidewater Telephone Company at a meeting at Gloucester Court House, Va., on the 19th, re-elected the old officers and added J. A. Bristow to the board of directors. The superintendent's report for the year showed that 5 per cent. had been earned upon the stock. The company has 77 stations.

The Mississippi Valley Telephone Company has been granted the right at St. Paul, Minn., to use all the public alleys in the district bounded by University, Selby, Cleveland and Herschel avenues for its pole lines. The work on the conduit lines of the company is well under way.

The Inter-State Telephone Company will erect a line between Winston and Greensboro, N. C., as soon as its construction force completes the new plant the company is putting in at Raleigh.

The American Telephone & Telegraph Company of New York has filed at Jefferson City, Mo., evidences of incorporation in Missouri, the capital to be used in that Stat being $10,000.

The stockholders of the Bell Telephone Company of Philadelphia on the 20th inst. voted unanimously to increase the capital stock from $2,000,000 to $3,000,000.

The Commercial Cable Company of New York has filed with the Secretary of State at Albany a certificate of increase of capital from $100,000 to $500,000.

The Inter-State Telephone & Telegraph Company has been granted a franchise to construct and operate an exchange at Salem, Va.

The telephone office at Tucson, Ariz., was destroyed by fire on the 18th inst.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Sept 26:						
Albany Ry. Co.	100	2,000,000	$1,750,000	1½ % Q., Feb. '98.	150	155
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Dec. 10, 97.	50	67
Traction Co. (Saratoga)	100	50,000	50,000	....	..	..
Allentown Pa.—Sept 26:						
Allentown & Lehigh Val. Trac. Co.	...	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Sept 26:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	89	..
Baltimore, Md.—Sept 26:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '97.	71	72
aBaltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 % S., Jan. 15, '98.	23⅜	23½
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—Sept 26:						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	...	..
North Shore Traction Co. com.	100	4,000,000	4,000,000	....	10	11½
North Shore Traction Co. pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	78½	80
b West End Street Ry. Co. com.	50	10,000,000	9,085,000	4 % S., Oct., '97.	85	85½
b West End Street Ry. Co. 8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '97.	106	106
Boston Elevated R. R.	100	10,000,000			69¾	75¼
Brooklyn N. Y.—Sept 26:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	60¾	60⅞
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR. guar	100	12,000,000	12,000,000	2½ % Q., Jan., 98.	214	216
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	285	..
Kings County Elevated	....	4,750,000	4,750,000	....	6	7
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	..	40
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Sept 26:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	....	67	68
*Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q. Dec., '97.	79	80
Columbus O.—Sept 26:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Feb., '98.	52½	54
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Sept 26:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '97.	..	..
Enterprise City RR. Co.	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Sept 26:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q., Dec. 31, 97.	292½	295
Chicago & South Side R. T. RR.	100	10,823,800	10,823,800	....	..	..
Lake Street Elevated RR.	100	10,000,000	10,000,000	....	13¾	14
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk.	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Jan., 98.	220	221
hNorth Chicago City RR.	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co.	100	20,000,000	13,189,000	1½ % Q., Feb, 98.	93	94
jChicago West Div. Ry. guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry. guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Sept 26:						
Cincinnati Inc. Plane Ry. com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry. pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co.	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118	118¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Sept 26:						
Akron, Bed. & Clev. Elec. Ry.	100	1,000,000	1,000,000	¾ % Jan., '98	38	40
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '97.	70	74
Cleveland Electric Ry.	100	12,000,000	12,000,000	¾ % Q., Oct., '97.	74	80
Detroit, Mich.—Sept 26:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co.	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry.	100	250,000	200,000	....	100	110
Dayton O.—Sept 26:						
City Railway Co. com.	100	1,500,000	1,470,600	1¼ % Q., Jan.1,'98.	104	105
City Railway Co. pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	108

*Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Sept 26:						
Hartford Street Ry. Co.	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	–
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	–
Holyoke Mass.—Sept 26:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	180	190
Hoboken, N. J.—Sept 26:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	70	–
Indianapolis, Ind—Sept 26:						
**Citizens' Passenger Ry.	....	5,000,000	5,000,000		25	26
Lancaster, Pa.—Sept 26:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000	....	..	–
Lancaster & Col. Electric Ry.	....	....	87,500	....	..	–
West End Street Railway	....	....	....	....	..	–
Louisville, Ky.—Sept 26:						
Louisville Ry. com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	35	39
Louisville Ry. 5 % pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '97.	101	103
Minneapolis, Minn.—Sept 26:						
Twin City Rapid Transit com.	100	17,000,000	15,010,000		25	..
Twin City Rapid Transit 7 % pfd.	....	3,000,000	1,714,200	1¾ %. Jan., '98.	101	102
Montreal, Canada.—Sept 26:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	278½	279
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1¾ % S., J. & J.	104⅜	104⅝
Memphis, Tenn.—Sept 26:						
Memphis Street Railway Co.	100	500,000	500,000	....	15	–
New Haven, Conn.—Sept 26:						
Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co.	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000	....	..	..
Winchester Avenue RR.	25	1,000,000	600,000	....	40	42
New Orleans, La.—Sept 26:						
Canal & Claiborne RR. Co.	40	240,000	240,000	4 % S., Jan., '98.	150	180
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	124
New Orleans Traction Co. com.	100	5,000,000	5,000,000		1	2
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000		5	8
aCrescent City RR. guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	28½
bNew Or. City & Lake RR. guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23	26
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	52½	55
New York—Sept 26:						
Central Crosstown RR.	100	600,000	600,000	2½ % Q., July, '97.	255	..
cChristopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., Jan., '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Feb., 98.	170	176
dMetropolitan Street Ry. Co.	100	30,000,000	30,000,000	1¾ % Q., Jan., 98.	156	156½
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '97.	84½	87
fBroadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2½ % Q., Oct., '97.	216½	225
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q., Jan, '98.	180	183
hEighth Avenue RR.	100	1,000,000	1,000,000	....	348	355
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q., Feb., '98.	360	..
jNinth Avenue RR. guar.	100	800,000	800,000	....	155	156
kSixth Avenue RR. guar	100	2,000,000	2,000,000	....	200	205
lTwenty-third St. R. R. Co. guar.	100	600,000	600,000	4½ % Q. Feb., '98.	310	..
Second Avenue RR.	100	2,500,000	1,862,000	2 % Q., Jan., '98.	178	180
Third Avenue RR.	100	12,000,000	10,000,000	2 % Q., Feb., '98.	170	175
m42d St., Manhatt'le & St. Nich. Av	100	2,500,000	2,500,000	....	68	..
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Sept 26:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	50¾	51½
Newark Passenger Ry.	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry.	100	504,000	504,000	11¼ % A.	195	205
Pittsburg, Pa.—Sept 26:						
Allegheny Traction Co.	50	500,000	500,000	....	...	50
oConsolidated Traction Co. com.	50	15,000,000	15,000,000	2 %, Jan., '95.	20¼	21¼
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	3 %, May, '97.	56½	56¾
pCentral Traction Co.	50	1,500,000	‖900,000	....	..	..
qCitizens' Traction Co.	50	3,000,000	‡3,000,000	6 % A.	63½	64
rDuquesne Traction Co.	50	3,000,000	‡3,000,000	6 % A.	..	..
sPittsburg Traction Co.	50	2,500,000	1,900,000	3 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	25
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	‖2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	½ %, Jan., '96.	28¾	28⅞
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 97.	..	..
Second Avenue Traction Co. com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co.	50	800,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %.

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¼ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co.

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass- Sept 26						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass- Sept 26						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.- Sept 26:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	80
Paterson, N. J.- Sept 26:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.- Sept 26						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	70	72
Philadelphia.- Sept 26:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14⅛	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‖533,900	3 % S—July, '98.	67⅛	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	65¼	66
Union Traction Co............ $12½ pd	50	30,000,000	29,930,450	....	19¼	19⅜
bElectric Traction Co	50	....	8,297,920	....	71½	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	315	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	392	..
fLehigh Avenue Ry. Co	50	1,000,000			47	..
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A. Mar. 98	268	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	185	186
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	186	...
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	4 % S—Oct. 1, '97.	90	91
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	136½	..
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	175	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	88	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	288	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖835,000	$11 sh. A., July, '98	275	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.- Sept 26:						
Rochester Railway Co	100	5,000,000	5,000,000	....	12	15
Reading, Pa.- Sept 26.						
fReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	20
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.- Sept 26:						
Fourth Street & Arsenal Ry	50	800,000	150,000		..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % July, '98.	180	182½
National Railway Co	..	2,500,000	2,479,000	1½ %, July, '98.	..	----
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000		..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '98.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % July, '98.	170	175
People's RR. Co	50	1,000,000	800,000	50c., Dec., '89.	..	..
Southern Electric Ry.......com.	50	500,000	500,000		57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	114	116
St. Louis & Suburban Ry	100	2,500,000	2,500,000		50	51
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.- Sept.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	106	107¾
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅞	54¼
Presidio & Ferries RR	100	1,000,000	550,000	....	8⅛	8⅞
Scranton, Pa- Sept 26:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.- Sept 26:						
Springfield Consolidated Ry	100	750,000	750,000	....	---	11
Springfield O.- Sept 26:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.- Sept 26:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.- Sept 26:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	101¾	104⅝
Montreal Street Railway Co	..	4,000,000	4,000,000	4 % S.	278½	279
Washington, D. C.- Sept 26:						
Belt Ry. Co	50	500,000	500,000		..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	74¼	75
Columbia Ry. Co	50	400,000	400,000	6 % A.	75	..
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	..	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	124½	125½
Worcester, Mass.- Sept 26:						
*Worcester Traction Co.......com.	100	8,000,000	8,000,000	....	16	18
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	98	96
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.- Sept 26:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1 %, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a. in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6¼ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.- Sept 26						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., July, '98.	282	285
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Jan. '98.	74⅛	..
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Feb. '98.	139	..
New York.- Sept 26:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	96	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	109	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	170	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	44
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Jan.., '98.	74½	..
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	118
*International Ocean Tel Co.guar6%	100	3,000,000	......	1½ % Q.	109	112
Mexican Telephone Co	100	2,000,000	......		..	.68
*New York & New Jersey Tel. Co.	100	5,000,000	3,728,000	1½ % Q., Jan., '98.	149½	150½
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	78	78
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., Jan. 1 '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Jan., '98.	91⅞	92
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.- Sept 26:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Feb. '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	171½	..
Chesapeake & Potomac Telep. Co.	100	......	......	....	47	55
Chicago Telephone Co	100	......	......	......	212	..
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	132½	134
Empire & Bay States Telegraph Co.	...	......	......	....	72	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	74	76
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	112	115
Providence (R. I.) Teleph. Co	50	....	......	....	86	90
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.- Sept 26:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	48¾	49¼
General Electric Co. [new] ...... "	100	18,276,000	18,276,000	......	81½	81¾
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2⅞	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	35½	36
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., July, '98.	57½	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.- Sept 26:						
Edison Elec. Ill'g Co., New York	100	9,188,000	7,988,000	....	180	184
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '97.	121	123
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	21	23
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug , 1898.	48¾	49¼
General Electric Co. [new].... "	100	18,276,000	18 276,000	......	81½	81¾
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.- Sept 26:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	130	140
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.- Sept 26:						
Edison Electric Light Co	100	2,000,000	......	......	144⅛	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	85½	86
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	43¾	45
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$32500 dis. Jan.11'97	18½	14
Southern Elec. Light & Power Co.	10	187,500	187,500	....	8	10
Miscellaneous.- Sept 26:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	35	40
Missouri-Edison (St. Louis)....com.	..	......	......	....	10	12
Eddy Electric Mfg. Co	25	......	......	....	---	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	120	..
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	4½	10
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	175	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '96.	83½	87
Rhode Island Elec. Protec. Co	100	......	......	....	118	125
Royal Elec. Co. (Montreal) [ex-div.]	..	1,000,000	.....	2% Q	159	159½
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	136	136¾
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	.....	......	....	100	110

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,000. of which $18,276,000 is common and $2,551,200 preferred.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.- Sept 26:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	85	87
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.- Sept 26:						
Consolidated Electric Storage Co	...	......	....	....	18	20
Edison European	..	......	....	......	1	3
Safety Car Heating & Lighting Co.	100	......	....	......	102½	105
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	80	85
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	95	97
Philadelphia, Pa.- Sept 26:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	--
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1½	1⅝
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74⅛	..
Welsbach Commercial Co.....com.	100	3,500,000	......	....	18	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	70	71
Welsbach Light Co	5	525,100	......	....	51	52
Welsbach Light Co., Canada.	5	500,000	......	....	..	2½
Pittsburg, Pa.- Sept 26:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	115	120
Miscellaneous.- Sept 26:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	...	12½
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	...	55
Billings & Spencer Co	25	......	....	....	80	87
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	82½	87½
Johns-Pratt Co	100	......	....	....	98	100
*Pratt & Whitney Co..........com.	100	......	....	....	4	8
*Pratt & Whitney Co...........pfd	100	.. ..	....	....	45	50
Stillwell-Bierce Co.............com.	..	......	....	....	70	80
Stillwell-Bierce Co.............pfd.	..	......	....	2 % Sept. 1, '97.	..	..
Shultz Belting Co	100	500,000	....	....	60	80
St. Charles Car Co	--	....	....	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Sept 26, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry.................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....
‖Watervliet Turnpike & RR. 1st mtg. 6s	350,000	350,000	1919	M. & N.	*118½	....
‖Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..................1st 5s	....	....	......	......	*105	105½

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Sept 26, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	......
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	......
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	105¼	105¾
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	102½	104
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co............1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	117	118
City & Suburban Ry.......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	115	115½
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	114¾	121
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Sept 2 , 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	105
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	106
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Sept 26, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR..........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry............1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Sept 26, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry ....1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¼	102⅝
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T............ 4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry......1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	104¼	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	53¾	54
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	106½	107
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	100¾
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	95½
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Sept 26, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	103¾	104
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

†Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Sept 26 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	10 ¾	104
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	103	104½
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	104	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	103	104¾
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Sept 26. 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry..................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Sept 26. 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	106	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 6	100,000	94,000	1909	M. & S.	102	......

*With interest. *Unlisted.

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—Sept 26, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR..........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR..............1st mtg. 6s.	......	50,000	189	M. & N.	101	....
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	194	J. & J.	76½	79
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	190	J. & D.	107	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	194	J. & J.	103⅛	104¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	......	....
Orleans Railroad Co........Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	105	110
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	......	...

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Sept 26, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	108	.....
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	120½	......
Broadway & 7th Ave..........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	107
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111½	114
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	......
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	104	105¼
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	117
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	......	......
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR.......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	108	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	......	80
Brooklyn Rapid Transit..........gold 5s.	7,000,000	5,181,000	1945	....	105½	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	102	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	112	......
Central Crosstown RR.........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100	......
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	1 5½	117½
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	96	98
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	120½	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1 ,500,000	1997	F. & A.	113¾	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	109	110
Second Avenue Ry...............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.)........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR............1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124	125
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	115
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	11 ½	112½

†$1,085,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Sept 26, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.......................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry..............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Sept 26, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	189	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	....	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	...
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	....	1943	....	102	103
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co.................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	.....
West End Passenger Ry..........1st mtg. 7s.	....	....	1905	....	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry.............2d mtg. 5s	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Sept 26. 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	92	95
Central Traction Co.................1st mtg. 5s.	375,000	375,000	1930	J. & J	......	....
Citizens' Traction Co..............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	117½
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	108½	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	106	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s	1,500,000	1,500,000	1929	M. & N.	105⅝	....
Pittsburg & West End.........1st mtg. 5s	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co......................5s	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s	500,000	500,000	1918	M. & S.	......	..

Providence R. I.

Date of Quotation—Sept 26, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	..
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation—Sept 26, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	108
Cass Ave. & Fair Gds. Ry.......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1918	J. & J.	111½	112½

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Sept 26, 1898						
Fourth St. & Arsenal St. Ry..1st mtg. 6s.	250,000	250,000	1908	J. & J.	..	..
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	100	102
Lindell Ry. Co....................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co........................	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co..........1st mtg. 6s.	400,000	300,000	1910	A. & O.	101	103
People's RR. Co..................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co...............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co..................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry...............Income 5s.	300,000	300,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	111	112
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	114½	115½
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Sept, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	113½	115
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	115½	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	93	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	126½	....
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127¼	128
†Park & Cliff House RR.........1st mtg. 6s.	850,000	850,000	1912	J. & J.	104½	105½
†Park & Ocean RR.................1st mtg. 6s.	250,000	250,000	1914	J. & J.	107	......
†Powell St. Ry.........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118	120
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Sept 26, 1898.						
Belt Ry. Co.......................Cons. mtg 5s.	500,000	450,000	1920	J. & J.	......	....
Columbia Ry...............................mtg. 6s.	500,000	500,000	1914	A. & O.	120	125
Eckington & Soldiers' Home. mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	121¾	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Sept 26, 1898.						
Bridgeport Traction Co.........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	112	114
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	110½	111½
¶Columbus (O.) St. Ry.......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	100	101½
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	108¾	109
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	100	102
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	86
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	115	115¾
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	94½	95
††No. Hudson Co. Ry. (N. J.) Cons. mtg. 5s	3,000,000	2,378,000	1928	J. & J.	103	104
No. Hudson Co. Ry. (N. J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.).......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	95	100
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry........................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Sept 26, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	106¾	....
Pittsburg, Pa.						
Date of Quotation—Sept 26, 1898						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Sept 26, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	109¾	110½
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	116¼	......
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Sept 26, 1898.						
American Bell Telephone......................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co..................7s.	....	......	......	......	....	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	103	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Sept 26, 1898.						
American Electric Heating...........5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co.....................	....	....	......	......	......	25
Barney & Smith Car Co.....................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co ....6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co........................	[illegible]	......	....	......	....	....
*Unlisted †Nominal						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12@12½c.; Lake, 12¼@12⅜c.; casting, 11⅞@12c.

The Lynn & Boston Street Railway Company has declared a semi-annual dividend of 4 per cent., payable September 30.

The Fourth Street & Arsenal Street Railway of St. Louis was sold under foreclosure on the 20th inst. to John H. Overall for $191,000.

The Westinghouse Electric & Manufacturing Company has declared a quarterly dividend of 1¾ per cent. on the preferred stock, payable October 1.

The Boston Electric Light Company has declared a regular quarterly dividend of 1½ per cent., payable October 15 to stock of record September 30.

Application has been made to list on the New York Stock Exchange Westinghouse Electric & Manufacturing Company $575,000 additional assenting stock.

The dividend of 50 cents per share on the stock of the Pennsylvania Manufacturing, Light & Power Company, Philadelphia, is payable October 15 to stockholders of record September 30.

George J. Gould since his return from Europe, judging from statements attributed to him, is more than ever impressed with the proposed change from steam to electricity on the Manhattan Elevated.

The directors of the Big Consolidated Street Railway, Cleveland, O., have ordered a fourth quarterly dividend of 1 per cent. Each of the three previous quarterly dividends for the year 1898 was three-quarters of 1 per cent.

The directors of the Louisville City Railway Company have declared payable the semi-annual dividend of 2½ per cent. on the preferred stock of the company, but owing to tax suits against the company by the city of Louisville the dividend on the common stock was passed.

The directors of the American Bell Telephone Company have declared the regular quarterly dividend of 3 per cent., payable October 15. The dividend makes 10½ per cent. declared so far this year, three regular quarterly dividends of 3 per cent. and 1½ per cent. extra dividend in June, payable July 15.

At the annual meeting of the Union Traction Company at Philadelphia on the 21st inst., the old board of directors, including J. Lowber Welsh, who was persuaded to reconsider his announced intention to retire, was re-elected without opposition. John B. Parsons has been elected president of the company and George Widener vice-president.

The plans for using electricity as the motive power on the Brooklyn Elevated Railroad are now so far advanced that a resolution providing for its use will be introduced at a meeting of the directors to-morrow (Thursday). The divisions of the road on which the electrical equipment will first be placed will be the Fifth and Lexington Avenue lines.

A report has been current during the week that the Third Avenue Railroad Company, New York, in changing their equipment to electricity will make provision for electric lighting. They recognize the economy of combining power and lighting interests in a great plant such as they intend to erect, on account of the strain from the two services coming at different periods of the day.

The City Passenger Railway Company of Baltimore offers its new stock of $1,000,000—issued by the company to pay for recent extensions and improvements—to such existing stockholders as desire to avail themselves of the privilege, at the rate of forty shares at $50 a share for each 100 shares of old stock held. The par value is $25 a share. This privilege expires on September 30.

The Edison Electric Illuminating Company of New York reports gross earnings for August of $202,516, an increase of $32,169 as compared with the same month of last year, and net $67,692, an increase of $1,470. For the eight months ending August 31 the gross earnings were $1,949,639, an increase of $379,072 as compared with the corresponding period of last year, and net $819,452, an increase of $122,481.

The Chicago "Times-Herald" of the 20th inst. says: "Announcement was made yesterday on competent authority that the City Railway Company has rid itself of a dangerous rival by absorbing the South Side Elevated Railway. It is stated that the surface road assumes $750,000 outstanding bonds and guarantees 4 per cent. on the $10,328,800 capital stock of the elevated. The transfer will take place, it is further said, January 1."

An official of the General Electric Company, who is credited with authority to speak, says: "The only relation that the General Electric Company sustains to the reported Walker-Westinghouse arrangement is that if the purchase has been made by the Westinghouse Company, the General Electric Company has the full right, by reason of its previous agreement with the Westinghouse Company, to use all the patents and devices of the Walker Company."

It is stated in the Boston "News Bureau" that "no plan has been definitely formulated as yet by the directors of the General Electric Company for the payment to preferred stockholders of accumulated dividends amounting to $35 per share. It may be said, however, that these dividends will be paid out of earnings subsequent to August 17, on which date the stockholders voted to reduce the capital stock, thereby wiping out the previously existing deficit of $12,000,000. About the middle of October it is expected that a definite plan for their payment will be prepared and issued to shareholders."

The United Electric Securities Company, Boston, under its 39th call retired $10,000 of its collateral 5 per cent. bonds of the fifth series at 100.8, leaving $432,000 of this issue still outstanding; $5,000 of the eighth series were retired at 102.4, leaving $256,000 outstanding; $24,000 of the ninth series were retired at 102.42, leaving $302,000 outstanding. The company invites proposals for the sale to it of so many of its collateral trust 5 per cent. bonds of the eighth series as can be purchased with $188,588. Proposals will be received at the office of the company until 12 o'clock M. October 5.

The New York "News Bureau" states that "President Albert L. Johnson of the Nassau Electric Railroad Company of Brooklyn confirms the report that R. T. Wilson had parted with his holdings to Edward H. Harriman, who probably represents ex-Governor Flower of the Brooklyn Rapid Transit system. Mr. Johnson also stated that if the object is to consolidate or combine the Nassau and Transit trolley railroads, by means of a traffic agreement or a lease, he would not be opposed to it if the scheme was a good one and not opposed to his interests." Mr. P. H. Flynn is understood to have softened in his opposition to the deal, but no definite arrangement has as yet been reached.

The Boston "Commercial Bulletin" of Saturday last says: "The sharp advances in General Electric from time to time have not been explained except by stories mostly invented to explain them. Thursday's advance was based on the report that George Gould's return from Europe would be followed by the adoption of electric traction on the New York elevated lines. Sooner or later the Manhattan will have to come to this, but it is making progress slowly. It was a little curious that in the face of this news, used as a 'bull argument' on General Electric, Manhattan stock should have suddenly broken nearly four points on Thursday, with sales of nearly 20,000 shares. One favorite Wall Street story has it that Pierpont Morgan has got control of the elevated lines. Of course this is nonsense. The only 'point' likely to turn out true is, that if the antequated management of the concern does not mend its ways and do something to retain its custom dividends will presently have to be suspended."

ELECTRICITY.

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ELECTRICITY

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CONTENTS.

EDITORIAL NOTES.

Electricity for the Operation of Gun Turrets on Men-of-War.

Now that three new first-class battle ships are about to be added to the United States Navy, the question as to whether it is advisable to have the gun turrets of these vessels operated by electricity or in the manner now generally in vogue, by steam, would seem an all-important one. Although much valuable information was gathered during the recent war as to construction and best type of ships for naval use, unfortunately, owing to a combination of circumstances, there was but little opportunity of judging of the real merit of electricity as a motive power for heavy work. So far as electricity was used, that is to say, for operating searchlights, signaling, ventilating, etc., it proved eminently satisfactory. To the best of our knowledge the Brooklyn alone of all the fleet utilized the electric current in the operation of a gun turret, and as no adverse report was sent in it is to be presumed that everything worked smoothly. There would certainly seem to be many advantages in utilizing electricity to operate the gun turrets and winches on a man-of-war. In the first place, a modern fighting ship has to be provided with anywhere from six to eight generating sets in order to obtain sufficient current for operating the signal bells, signal lamps, incandescent lamps and searchlights. Thus, with very little more power added, numerous steam rams and donkey engines now required in the handling of the ammunition and turrets could be done away with entirely. With the present system no less than three bulky engines are required in a turret not over fifteen feet in diameter, whereas were electricity adopted one small motor could in all probability be made to do the work. A method of accomplishing this was recently described in the New York *Sun* as follows:

"The exact manner in which the electric current would be applied to the turret gear has not yet been determined. Many schemes have been devised, all of them practical according to the ideas of the officers in the Construction Department. One plan provides for a large motor to be situated in one of the ducts leading to the turret. This motor would furnish the necessary power for the operation of the turret itself, as well as the two lifts needed to bring the projectile into position. By this system the rams would be dispensed with altogether, as the projectile would be placed upon a little motor car in the magazine, carried by it to the lift, raising it to the level of the floor of the turret, and thence to the lift communicating with the breech of the gun. The place of the myriad steampipes, donkey engines, greasy hydraulic cylinders and complicated levers would be occupied by two small electric cables, while the officer in command by throwing a switch on the board placed in the firing tower in the turret would have under his own control the working of the entire system."

The doing away with bulky steam pipes is decidedly an advantage, as the temperature would be reduced as well as the danger. There would certainly seem to be a far greater chance of a pipe's being perforated by the bursting of a shell than of a wire being broken, as the former would naturally offer a far greater surface than the latter and could moreover not be so easily repaired. The main electrical conductors could, for that matter, be protected by running them in heavy insulated cables under the deck. Of course there is always a chance of a breakdown occurring in the dynamo room, but with eight or ten generating sets so arranged that any set may be switched into any circuit little trouble need be apprehended from such a cause. As it is the aim of the United States that these three battle ships when completed, which however will probably not be for three years, shall be the finest and most modern warships afloat, provision should be made for operating the gun turrets and other heavy machinery by electricity, otherwise we shall awake to find that Germany, which is fast adopting electricity in its navy, has not been so conservative, and that our newest warships are in reality not up to date.

* * *

Lower Rates for Electric Current.

From all accounts the New York gas companies will be obliged to look after their laurels, and may not have such a monopoly in the illuminating line as they have been enjoying for past years. A strong competitor has entered the field against them in the Edison Electric Illuminating Company—not that the latter concern has not been in the field some time, but until now the prices charged for electric light were such as to make it almost a luxury. A few days ago the Edison Company sent out a circular addressed to its customers stating that owing to the adoption of new apparatus, combined with the use of cheaper fuel, it is in a position to offer electric current at much lower rates than heretofore. The prospectus says:

"The Edison Company, in accord with its declared policy of reducing prices and encouraging the more general consumption of electric current, particularly for long-hour use, and in continuation of the reductions announced in its circular letter of October 28, 1897, will replace its present schedules for both incandescent and arc lighting by the reduced rates

scheduled below, on bills due after October 15, 1898 (including partially September lighting).

"These rates give customers the benefit of the fact that electricity for long-hour use can be produced and sold cheaper than any rival illuminant. A consumer using one lamp 8 hours a day requires an investment in station apparatus and street conductors only one-eighth that required by a consumer using 8 lamps one hour a day though the consumption for one day is the same in both cases. Although operating costs, for coal and other supplies, varying almost directly with the amount of electricity produced, do not show a like saving, yet the long-hour user can be supplied at a much lower rate per hour than the short-hour user, reaching half or less proportion of the one-hour price.

"For retail use, 20 cents per kilowatt hour (equivalent to 1 cent per 16 candle power 50 watt incandescent lamp hour, or 10 cents per standard arc lamp hour) for first hour's average daily use of the total lamp equivalent connected; 15 cents (¾ cent or 7½ cents) for the second hour; 10 cents (½ cent or 5 cents) for the third and fourth hours; and 5 cents (¼ cent or 2½ cents) for all use above four hours.

"For wholesale use, with a guarantee of 2,000 kilowatt hours consumption each month and two hours average daily use of installation, 10 cents per kilowatt hour for the first four hours average daily use and 5 cents for all use above four hours; or, at the option of the consumer, the present wholesale or kilowatt rate of 10, 9, 8 and 7 cents per kilowatt hour for 2, 4, 6 and 8 hours average daily use, with reductions for quantity, etc.

"These prices cover both incandescent and arc lighting and include renewal of incandescent lamps (not exceeding one 16 CP. lamp for each 20 kilowatt hours), and the carbons and trimmings for arc lamps, but not first supply of lamps. The company, however, in accordance with general practice, waives for the present the last condition and continues, until further notice, the first supply of incandescent lamps."

It is further announced that, provided the present rates prove as successful as the officers of the company are led to believe they will, a still further reduction for long-hour use may be made to ¾ cent per 16 CP. incandescent lamp hour. This reduction in the price of electric light should without question greatly increase the number of private consumers, especially now that electric light will cost no more than gas for long hour use. The latter illuminant is used by people of moderate means throughout the city almost exclusively, owing to the fact that electricity has heretofore been considered too expensive. But probably the principal aim of the Edison Company in thus reducing its rates is to create a demand for electricity in cooking and heating, and thus secure if possible a day load for its central stations. A considerable amount of cooking is at present being done in this city by gas, and if electricity can be furnished equally as cheap there would seem to be no reason why the electric current should not gradually be adopted for this purpose. In fact the circular, referring to this subject, says: "To encourage cooking, heating, etc., by electricity, household apparatus for cooking, heating and ventilating will until further notice be excluded in reckoning installation." This we presume means that a person using electricity for cooking or heating purposes would be charged for it the same as though the current was utilized for lighting, which, together with the current used for lighting, would make long-hour use, and consequently be charged for at a lower rate. By adopting these measures the Edison Company may possibly solve a vexed question and secure a day load, or possibly this reduction in the price of electricity may be the means of bringing about what legislative action has repeatedly failed to do, namely, a material reduction in the price of gas in this city.

Electricity in Belgium. Belgium is apparently appreciating the advantages of electricity for lighting and power purposes in spite of strenuous opposition to its introduction by the owners of gas works in various cities throughout that country. From an official report furnished by the Bureau of Foreign Commerce it is learned that the first trial of the complete electric installation for the lighting of the railway station known as the Gare du Midi in Brussels was but recently made and proved entirely satisfactory. The Government was in fact so well pleased that it has recently signed a contract for a similar installation in the South Depot at Ghent.

When the city authorities of Brussels, but a few years ago, proposed the question of lighting public places, such as railway stations, parks, etc., by electricity, and of supplying electricity to subscribers the same as gas, a great cry was raised and protestations made against any such innovation, insisting that it would ruin the gas works and bankrupt the communal exchequer. What little foundation there actually was for any such apprehension, however, may be gathered from recent statistics which go to show that during the past year not only has the use of electricity increased but also that the profit from the sale of gas is considerably in excess of that of previous years. This fact, strange as it may seem, is by no means unusual, and although seemingly contrary to what might have been expected, is simply another proof that the introduction of electricity into a community does not necessarily mean bankruptcy to the local gas company.

The most important installation now being made in Brussels is in the king's palace. When the work is finally completed there will be 7,500 lamps in all, of which a large number will be of five candle-power, located in the many chandeliers illuminating the ball and reception rooms.

In the city system there are now about 47,391 lamps, a large number of which are of sixteen candle power, averaging 117 lamps per hundred running meters of street. Included in the above number are 770 arc lamps. There are twenty eight electric motors in the system, varying from one-tenth to ten horse power and aggregating a total of 150 horse-power.

The maximum sale of electric current during 1897 was 8,763 amperes, corresponding to that necessary to operate about 17,530 lamps of 16 candle power functioning simultaneously, or about 37 per cent. of all the lamps at present installed.

In view of the increasing use of electricity in Belgium, there would seem to be an excellent opportunity for the introduction of American electrical apparatus, although difficulty might be experienced in competing successfully with machinery manufactured in Germany owing to the proximity of the latter country.

Under the Searchlight.

Notes and Comments on Various Topics.

THE Worcester (Mass.) *Telegram* says experts are beginning to believe that the danger to life and property from thunder-storms in suburban localities is increased by the increasing use of electricity in the cities. Now, there is a great deal of suburb around electric New York, much of it in New Jersey, but we have not heard of any remarkable increase in damage or fatality due to thunder-storms in late years, and even "Jersey lightning," whose reputation as a killer dates from away back, has grown if anything a little less nocuous since the product of the dynamo came into general use.

* * *

THE motor car movement has, says the London *Financial Times*, enriched the English language with some new and particularly ugly words, but it would appear that we must not complain, for the Flemish Academy at Antwerp has been discussing the correct equivalent of the French "automobile," and, among other suggestions, has had to deal with that of "Snelpaardelooszonderspoorwegpetroolrijtuig." The expression appears to require a good deal of sub-editing before the citizens of Antwerp can hope to save time by hailing a vehicle of this description.

* * *

Wanted Something Fresh.

The following interesting little anecdote is from *Lightning*, London: "The retired provision merchant had a few thousands for investment, and his nephew, who traveled in most things electrical, from lampholders and storage cells to dynamos, motors, and meters—and in a motor car—had his eye on those same thousands. So he took his venerable relative round to an accumulator shop, and explained in highly technical language the advantages of the particular type of cell in which he was interested, and especially how the depreciation had been brought down to an insignificant figure. He was great at technicalities, and from their constant use had come to think himself a consulting electrical engineer. But the old man was not impressed. 'How long do these things last, then?' he asked. 'For years; haven't I just been explaining it to you?' 'Then they won't do for me,' replied the ex-provision merchant. 'What I like to deal in are the things you start to sell fresh every morning.' Even that did not discourage the bagman. He promptly took his victim round to a factory for arc lamp carbons, where the desired deal came off."

* * *

THE St. Louis *Chronicle* of September 28 says: "Dr. Heber Robart thinks he has found a cure for asthma by the use of electricity. Gertrude Pence, the 11-year-old daughter of Daniel Pence, a prominent citizen of Springfield, Mo., was cured. It was the first experiment along lines never before attempted by a surgeon in this country. The electricity was applied in spray form through wooden electrodes."

* * *

ELECTRICITY is not all of life, and it is a relief to sometimes direct the beams of our searchlight beyond its confines and bring to view some of those things that are lying around outside. In the San Francisco *Examiner* of a recent date we find the following conversion of our national hymn, "My Country, 'Tis of Thee," into Spanish by one Don Tomas de Nunan. Although it is evident that Don Nunan, in setting out to accomplish the translation, mounted a bucking broncho instead of the ordinary Pegasus, it is quite as evident that he got there all the same:

Mi patria, de ti,
Cuba y Puerto Ri—
co libre son.

Comprendo Tio Sam
Un hombre fuerte am,
Although tenemos ham—
bre muy mal.

Las Filipinas, si!
El Senor Dewey, he—
Caramba! Ay de mi!
Has taken them.

Our great buques de guer—
Ra! Gallant ships that were!
Porque did we imper—
il them near Schley?

Re-cu-er-da el Maine!
We faced their flag in vain—
They're raising el in Spain!
Raising hob son!

Mi patria! ha, ni
Las islas en el sea
Ni ironclads have we—
Ni nada left.

* * *

THE *Electrical Engineer* of London says: "The other day we happened to be on board ship with a

number of well-known engineers as well as a general cargo of passengers. One of the general cargo let everyone around him know that he was an electrical engineer. We have in our time met many electrical engineers, but had never previously seen to our knowledge this particular specimen, nor do we ever wish to see him again. Some of the engineers aboard were closely connected with electrical undertakings, and naturally questions were asked—and answered by the specimen. Now practical men always harp on the question of cost, so it was news to some of us to hear the specimen emphatically assert and reiterate again and again that the total cost of generation per unit could not be much less than 6d. Under exceptional circumstances it might be reduced to 4d. The moral is this—do not talk with strangers on subjects you know very little about. As one gentleman remarked, 'I knew a good deal more than he imagined, and so could not believe anything he said.' The best of it was, the specimen quoted chapter and verse for his statements, and the singularity of his proofs was that they always concerned installations by 'Lord This' and 'Sir Somebody' that." Unfortunately for the good of the electrical industry, this type of so-called engineer is frequently to be met with in other countries besides England.

"MONEY IN RAILROAD BUILDING."

Under the above caption the article subjoined appeared in the Brooklyn (N.Y.) *Eagle* of September 29. It is suggestive:

"Albert N. Johnson, president of the Nassau Electric Railroad Company, has said in discussing the prospective consolidation of all the railroads in this borough that he will withdraw from active connection with the consolidated company if the present plans should be carried out. He can make more money building railroads or developing those in bad condition. Mr. Johnson knows whereof he speaks. People who have followed the history of the Nassau system and of the other railroad systems in this borough have no doubt of the correctness of his views. Let us look at some reported facts: The original Nassau system was bonded for $4,000,000 and stock to the amount of $6,000,000 was issued. The bonds were supposed to cover all the cost of construction, including the cost of obtaining the franchises and consents of property owners. The stock was issued as bonus to the men who took the bonds, and in payment of commissions for raising the money. Patrick H. Flynn obtained one-half of the $4,000,000 of bonds, the other half went to the Wilsons, who were the capitalists of the concern, and to the Johnsons, who supplied the railroad experience. The Wilsons received about one-half of the capital stock and the other half was divided between the Johnsons and Flynn. This was about five years ago. The Nassau system later absorbed the Atlantic Avenue system and there was a recapitalization of the consolidated roads to the amount of $15,000,000. Of this the Wilsons are supposed to have held about $10,000,000, and the Johnsons and Flynn the remainder, or about $5,000,000. The Wilsons have sold their holdings of stock to men supposed to be interested in the Brooklyn Heights system on a basis of about 80 per cent. of its par value. The Johnsons are said to be asking par for their holdings. They will probably get somewhere near that figure.

"Now assuming that the original bonds of the Nassau system represented actual cash expended, there is a profit in about five years on an investment of $4,000,000 of the respectable amount of at least $5,000,000. This does not take into account the money made on the recapitalization of the Atlantic Avenue Company after consolidation. It simply includes the original Nassau road. The stock, while not representing cash invested, does represent what the promoters of the railroad think that the business is worth. In other words the stock is the capitalization of the value of the franchises. Each share represents a proportionate share of the profits of the road. If there are no profits above operating expenses then the stock is worth little save for speculative purposes. In view of all these facts no one will doubt Mr. Johnson's statement that there is more money in developing than in operating railroads."

Meeting of the American Institute of Electrical Engineers.

The American Institute of Electrical Engineers held its 127th meeting at its headquarters, 12 West 31st street, New York, on Wednesday evening, September 28. The meeting was called to order about 8 o'clock with Dr. Kennelly in the chair. After the usual routine of business had been gone through with, a paper entitled "The Photometry of the Enclosed Alternating Arc," by Charles P. Matthews, W. H. Thompson and J. E. Hilbish was read. An interesting discussion followed in which Louis B. Marks, W. H. Freedman, Captain John Millis of the Lighthouse Board, and Dr. Kennelly took part. About fifty members were present. The meeting adjourned about 10 o'clock. At the meeting of the council on September 28 the following were elected into the Institute:

Frederick William Carter, Lecturer in Electrical Technology City and Guilds of London Institute, London, Eng.

Walter H. Coleman, Superintendent and Treasurer Andover Electric Co., Andover, Mass.

Henry L. Doherty, General Manager and Engineer Madison Gas & Electric Co., Madison, Wis.

George W. Frank, Jr., Secretary, Treasurer and General Manager Kearney Electric Co., Kearney, Neb.

R. H. Mansfield, Jr., Electrical Engineer and General Manager Ward Leonard Electric Co., Bronxville, N. Y.

Kempster B. Miller, Chief Electrician Western Telephone Construction Co., Chicago, Ill.

Gilbert Rosenbusch, Engineer Sprague Electric Co., South Orange, N. J.

John West Thompson, Superintendent Cia. de Luz'y Fuerza Motriz Electrica, Guadelajara, Mexico.

Henri Tripier, Counsel and Technical Engineer of the Compagnie des Transports Electriques del Exposition, Paris, France.

Herbert A. Wagner, General Superintendent Missouri-Edison Electric Co., and also with Wagner Electric Mfg. Co., St. Louis, Mo.

William Henry Williams, Professor of Mechanical and Electrical Engineering Montana State College, Bozeman, Mont.

A New Company With a Big Capital.

The New York Gas & Electric Light, Heat and Power Company, with a capital of $25,000,000, was incorporated on the 3d inst. at Albany. Its stated objects are to manufacture and supply gas and electricity for light, heat and power purposes in the territory of Greater New York. The corporation is to have the right to purchase and hold the stocks and bonds of any foreign or domestic corporations and exchange therefor its own stocks and bonds. The organization tax of $31,250 was paid to the State Treasurer by a check of the Central Trust Company drawn on the Bank of America. The directors are Henry J. Hemmens, Frank D. Allen, Frederick L. Allen, J. Frank Yawger, Louis M. King, Charles N. Flint and Nathaniel W. Smith of New York City.

Consolidation Completed.

The consolidation of the Edison Electric Illuminating Company of Brooklyn with the Kings County Electric Light & Power Company was completed on Monday last. The Kings County Company becomes the owner of the Edison stock, and by virtue of the ownership of this stock will own the stock of the Citizens' Lighting Company and the Municipal Lighting Company of Brooklyn. This purchase gives the Kings County Company substantially all the electric light business in the borough of Brooklyn.

CALCIUM CARBIDE WORKS AT INGLETON.*

BY F. J. A. MATTHEWS.

The advantages claimed during the past two or three years for the new illuminant, acetylene gas, added to the number of patents applied for for generators by persons living in Lancashire, Yorkshire, and other populous centers, and the consequent advertisement of the new gas, have directed the attention of many engaged in the production of lime to the subject of the manufacture of calcium carbide. Amongst others Mr. James Carter, of Blackburn, well known in the district as a coal merchant and lime burner, and who possesses extensive quarries and kilns at Clitheroe, was attracted by the commercial prospects of its manufacture on a large scale in the heart of the industrial region where it would be used, and the saving of its heavy rate of freight. Accordingly, he approached Messrs. Ashton, Frost & Co. (Limited), engineers, of Blackburn, with the view of having experiments carried out in their works. With this suggestion Mr. Park, the general manager, readily agreed, and I, as chief electrician, was instructed to build an experimental furnace, and for several successive weeks trials were made under varying conditions. This furnace was simply a crude brick contrivance lined with ganister, with vertical carbons, and completely open at the top. As the only dynamo we could spare for any lengthy trials gave as its utmost output 65 volts 400 amperes, and the open furnace permitted a vast quantity of valuable heat to escape, we found the cost of manufacture to be heavy, and the carbide to be unequal, that is, we got lumps of very pure carbide exceedingly rich in gas, but mingled with it masses of unfused, and partially fused, lime and coke. However, sufficient data were obtained to show that not only were the samples of lime and coke used of the best for this purpose, but also, with modern appliances and a current of not less than 1,500 to 2,000 amperes, the carbide could be produced at a price which would leave a fair margin of profit, especially if, as in the case under consideration, water power were available, even allowing for the fall in market price which was inevitable with the opening of many new factories.

At the same time it was considered advisable, as ample money could be found for the project, to proceed only on the most modern and efficient lines; about this time M. Raoul Pictet published his two pamphlets—"Le Carbite Nouveaux Procédés pour sa Fabrication" and "L'Acétylène, son Passé, son Présent, son Avènir." After careful consideration of M. Pictet's patents and system with those of others, it was finally decided to secure a license to build one of his furnaces, and eventually terms were arranged, and a convenient site secured a Ingleton.

Before, however, describing the actual plant at Ingleton it would be well, as these are the first furnaces erected under M. Pictet's patents in the United Kingdom, to give a brief sketch of the principle upon which M. Pictet has founded his system. The chemical formula for calcium carbide is CaC, and to obtain this (outside purely laboratory methods) lime (CaO) and coke (C), each in a fine powder, are mixed together approximately in the proportion of 65 per cent. of lime to 35 per cent. of coke, and raised to a high temperature, roughly about 6,000° F.; usually this has been done at one operation by means of the electric arc in a suitable furnace. The chemical changes which take place in the furnace, while the mass is subjected to this tremendous heat, consist in the greater part in the oxygen being driven off the calcium and uniting with a certain percentage of the carbon to form the monoxide and dioxide of carbon, chiefly the former, while at the

* From the *Electrician*, London.

same time the calcium combines with the carbon to form the required calcium carbide. The combination of the oxygen with the carbon, and of the calcium with the carbon, are both of the nature of combustion and evolve heat in so combining, but this heat cannot be used directly in the furnace, owing to the high temperature required in order to drive off the oxygen from the lime, and also because a very high temperature is necessary to enable calcium and carbon to unite. The various purposes for which thermal units are required may be tabulated thus:

(1) To raise the lime to the temperature of liquefaction.

(2) To supply the latent heat of liquefaction.

(3) To provide the heat necessary to disassociate the lime.

(4) To provide the heat requisite for the combination of calcium and carbon.

M. Pictet points out in his pamphlet that in order to procure an intense cold, say for the liquefaction of air, no one would think of proceeding by one single operation, but by several progressive steps; so also to obtain an excessively high temperature, recourse should be had to the same method of advancing by successive means, hence his first furnace was built in a series of zones. Starting at the top we have: (1) An ordinary blast furnace, coke being used for fuel, where obtains a temperature of 3,600° F. (2) An oxy-hydrogen blow-pipe zone, where obtains a temperature of 4,300° F. (3) An electric arc zone where obtains a temperature of 5,600° F. to 6,000° F. By this method the electric arc only comes to the assistance when all other cheaper means of securing a high temperature have done their utmost, and as the furnace is fed from the top, and the mass gradually sinks down and comes under the influence of each zone successively, the cost of manufacture is greatly reduced. In actual practice the second or blow-pipe zone might be omitted, as the benefits derived from it are not commensurate with its cost. In his later furnaces, such as those at Ingleton, built under a more recent patent, several alterations are made, and while the same broad principle is maintained of proceeding by degrees, the waste gases of the furnace and the heat obtained by the combination of the calcium and the oxygen with the carbon are made to do the work of the two first zones described above.

At Ingleton the plant consists of two furnaces, one 120 kilowatt dynamo, driven from a waterwheel 30 ft. in diameter, with a 12 ft. bay, assisted in time of drouth by a pair of compound horizontal condensing engines. The dynamo possesses several new features. Its normal output is 2,000 amperes, at 60 volts, with 425 revolutions per minute, but it had been designed to run without sparking even when temporarily overloaded to an extent of 50 per cent. It is of the makers' four-pole type, with cast-steel magnets and yoke; the armature is of the slotted drum type, with helical duplex winding, the armature inductors being of Crompton's patent compressed stranded cable, the end connections being carried on a special prolongation of the spider. There are 68 sections to the commutator and 68 inductors to each part of the duplex winding. In order to prevent sparking owing to the armature reactions when the machine is grossly overloaded, overcoming the magnetic flux of the field, a slot $1\frac{1}{4}$ in. in width and the full width of the magnet is cut through each magnet and pole, and continued through the yoke at right angles to the lamination of the armature. Exhaustive tests were also made in order to obtain the exact bore and correct rounding of the polar shoes, to secure as far as possible absolute fixity of lead, with the result that the machine runs without alteration of lead with variations of from 1,000 to 1,500 amperes, this being in dynamos for furnace work a most essential feature, as the molten mass in the furnace is constantly causing the external resistance of the circuit to vary, and the current fluctuated in one particular run from 800 to 2,500 amperes—17 times in 10 minutes. The compounding turns consist of a sheath of polished copper on each field. The brushes are 16 in number, in four rows of four each, the rocker being operated by a worm gear and hand-wheel. The armature complete weighs 30 cwt., and the whole machine 7 tons. The designs and drawings of this machine were checked by and the tests carried out under the superintendence of Mr. Albion T. Snell, the consulting engineer.

The furnaces are two in number, but as each furnace requires 2,000 amperes for economical working, the second is intended, until the generating plant is increased, for use in case of breakdown to the first. The furnaces now consist of an inner part or furnace proper, roughly 2 ft. square by 3 ft. high; this part is built of bauxite bricks, with an outer casing of fireclay bricks. At the front there is a partition between the two, in which before the furnace is started a fire is kindled. The carbons are 6 in. square, the negative one being inclined at an angle of 30 deg., while the positive carbon is fed forward by a screw motion which gives a horizontal travel. Where each carbon enters the furnace wall it is surrounded by a sheet-iron water jacket. A second water jacket is also fixed round the part of the copper carbon holder where the cable is sweated in. A good water circulation is maintained from cisterns placed in the room above, while, in order to prevent short-circuiting, the water jackets on each side are supplied from separate cisterns, which are supported on wooden stands, and the overflow from the jackets is made to drop from a good height into a common waste pipe. Each pipe, both supply and waste, is provided with a stop-cock to regulate the flow, and no pipe is of continuous metal, but for 6 in. of its length consists of india-rubber.

Each furnace is built on foundations of ordinary brick, provision being made for a track to be run underneath, into which the molten carbide falls. Along with the carbide a large quantity of carbon monoxide escapes from the furnace, and a flue at the back of this opening, assisted by a good draught, leads this round the furnace between the two linings to the top of the furnace where the hot gases are utilized. From the top of the furnace proper an iron tube, inclined at an angle of 25 deg., leads to the upper chamber. This tube is perforated along its upper part to permit of the escape of the hot gases, and is enclosed in a firebrick flue. Where the flue reaches the floor of the top room it is bent at right angles to its former direction, but the inner tube is carried straight on through the flue-slide into the room, and there closed by a suitable door, while the flue proper is continued into the shaft of the chimney. Through this tube the furnace is fed with the mixture of carbon and lime, while along the flue travels the carbon monoxide from the furnace together with the other hot gases, the fire, referred to above, in the front of the furnace being made to create a draught in the first instance. These hot gases, greatly assisted by the heat of combination of both the calcium and the oxygen with the carbon, heat the constituent materials as they pass down the tube, so that they enter the furnace proper already at a high temperature. The lime and coke are compressed into briquettes about 2 in. square, in order not to choke the arc, and allow a freer passage for the escape of the hot gases.

The main switchboard consists of an enamelled slate board mounted with a 12 in. dial voltmeter reaching to 75 volts, an ampere-meter with 12-in. dial reading to 2,500 amperes, and graduated to read in 20 amperes, double pole fuses, and a shunt resistance and multiple switch. Each furnace is further controlled by a single-pole multiple lever switch. The main cable consists of such a number of strands of 19s. B.W.G. copper wire as give three square inches of solid copper and is compressed to a rectangle $2\frac{1}{2}$ in. by 2 in.; this cable is run along the floor on insulators and where it rises to the carbons is suspended by suitable swinging hangers from the roof. The gearing is of a very strong and substantial nature, the dynamo being driven by a 45-in. pulley adapted for six ropes $1\frac{1}{2}$ in. in diameter; the intermediate drive with a lower belt speed consists of ten ropes $1\frac{1}{2}$ in. in diameter, while the bearings are automatically lubricated by means of rings dipping into an oil reservoir.

The plant has now been working for the past week or two with most satisfactory results, and the carbide tested by an independent expert yields an average of 5 cubic feet to the pound.

POSSIBLE FUTURE MOTIVE POWER FOR TRAMWAYS.*

BY W. H. BOOTH.

There can be no doubt that the next great industrial movement in Great Britain will be in the direction of electrical traction. Everything has pointed that way for some time. Something we want, and have wanted for years, and we are unable to define just what this something is. A year or two ago the light railway fever broke out, but this was but a symptom of a deeper seated complaint, which will find its cure in the establishment of electrical traction, not in the fitful manner to which we are so far accustomed, but in a downright business manner. For the present, doubtless, electrical tramways will be worked from ordinary power stations deriving their power from the combustion of coal. But it is questionable if this wasteful system will continue; we say wasteful, because there is running to waste in Great Britain a very Niagara of power, of which, so far, the only utilization has been—to continue a hydraulic simile—by means of a small float wheel anchored in the rapid current, no real use of the fall being made. The waste referred to is that which goes on week in, week out, every day of twenty-four hours, Sunday included, from year end to year end, and continuously as Niagara itself, in the shape of gases discharged from the blast furnaces of the iron manufacturing districts. Roughly some ten or twelve million tons of fuel are consumed annually in the making of pig iron in Great Britain, and it has been estimated that if the gas could be properly utilized it would produce continuously nearly two and a half million horse-power. It is perfectly obvious that, granted the possibility of using the gas, there need be no fear for the future of electrical tramways, or indeed any other form of electrical utilization.

All waste powers have been found to call for very considerable expenditure in bringing them to a position for being utilized. Water power, for example, requires such heavy outlays on canals, dams, pipe lines and tunnels, that it is very seriously doubted whether it can compete with steam power. It can well compete in southern California, where coal is imported from England and is very costly, and there is no frost and therefore no need for the expense of a stand-by steam plant, but in the Eastern States of America, with their severe winters and the necessity of steam plant as a stand by, the saving by water power is very problematical.

Turn now to the case of the blast furnace and note the contrast. In the first place the blast furnace is already in existence and fuel is already being consumed therein. Compared with a steam power plant, we have already got the equivalent for the boiler and we have the fuel to use up as a waste product. Compared with a water power plant we have got everything except the turbine. We have all the head works and pipes. All that remains to be done is to put down gas engines and dynamos and manufacture electricity for transmission to any reasonable radius round every blast furnace. To

* From *Railway World*, London.

Mr. B. H. Thwaite is due the credit of seeing the waste and supplying the remedy. He recognized that the gas produced by the blast furnace was almost identical with that produced by the gas producer, and at once realized the possibility of using it in gas engines. The first plant put down for the purpose was at the works of the Glasgow Steel & Iron Company, at Wishaw, near Glasgow, and being called in to make a test of this plant I am able to give a few figures from the results I found. First, however, attention may be drawn to the accompanying two analyses, the one of ordinary producer gas, or *gaz-pauvre*, as it is termed in France, where a good deal has been done in the way of using it for power purposes, and another from a blast furnace and taken for me by Mr. Galbraith, the manager of the Wishaw works.

TABLE I.

	Blast furnaces at Wishaw.	Average of four typical gas producers.	Average of four typical blast furnaces.
Carbonic Oxide CO......	24.75	27.61	30.76
Hydrogen H..................	2.33	3.59	0.50
Marsh Gas CH_4..........	0.75	1.21	0.80
Nitrogen N..................	66.42	61.10	53.60
Carbonic Acid CO_2.....	5.75	6.49	14.44
	100.00	100.00	100.10
Per cent. combustible..	27.83	32.41	32.06

It will be noticed that approximately one-third of each gas is combustible, the remainder being diluents and of course chiefly nitrogen. Such diluted gases are not perhaps very inflammable, but they do burn fairly well under steam boilers, though they are very inefficient as steam producers, owing to their lack of heat radiating power and also to the low temperature of the flame they produce. When Mr. Thwaite first proposed to use these waste gases, he was of course laughed at, but this did not deter him. Having command of a gas producer, he made a gas exactly resembling blast furnace gas, and proved its capability in a gas engine of several horse-power driving a dynamo and producing light. The modern gas engine with its compressive cycle can use very poor gas; the compression gets over all difficulties of this nature, and for hours the engine at Wishaw never made a "miss fire," nor could I learn from anyone that he had seen or heard it do so. The demonstration plant laid down to test the issue consists of a gas engine of 20 horse-power, which draws its gas through a holder or gasometer supplied by a fan or blower which draws air from the large gas pipe returning the gas from the residuals recovery plant, coal being the fuel used in these as in other Scotch furnaces, and a residuals plant being therefore necessary. The whole plant is thus exceedingly simple. The gas engine drives a dynamo, which supplies current at 100 volts to the following lamps—10 arc lamps placed in five groups of two in series, one incandescent lamp of 50 candle-power, 11 of 32 candle-power and 68 of 16 candle-power, used variously to light the furnaces, the residuals plant and the offices. If the output of gas per ton of fuel used is known, the combustion of gas by the engine can be read off from the fall of the holder in a given time, the plant being so arranged that when a test is to be made the supply of gas to the holder can be stopped, and the gas from the blower returned by a bye-pass to the large gas main. The holder being 10 feet diameter is amply large to allow several minutes' run, and the voltmeter being kept steady and all lamps alight, the electrical horse-power is known, and the consumption of gas per horse-power is thus measurable. With gas produced at the rate of 180,000 cubic feet per ton, the consumption is as low as 105 cubic feet per hour per electrical horse-power. Somewhat poorer gas was being made at the time of my tests, and it probably measured 200,000 cubic feet per ton of coal consumed. The result was thus 140 cubic feet per electrical horse-power hour, which corresponds with a weight of 1.49 pounds of coal. Practically and briefly it may be stated that the first attempt to use blast furnace gas showed that after smelting the iron there could still be obtained from each $1\frac{1}{2}$ lbs. of coal one electrical horse-power—a better result than that obtained with the highest class of steam boilers and triple expansion engines, and there can be no doubt of the absolute success of the system, which has since been put into operation at the Frodingham Iron Works, in Lincolnshire, with equal success. For local duty the system will grow rapidly, but it would have been useless for other work but for the possibilities of electrical transmission. With this available, and power to transmit current 100 miles with a loss of only 30 per cent., there are opened up vast possibilities for traction work, factory driving, etc.

It is to traction work, however, that the new source of power will give the greatest impetus, and it is fitting that the movement promising so great an economy should be directed in the line of traction, that youngest of industries, and one requiring large powers. The certainty, uniformity and regularity of production of gas serve to render the blast furnace not merely ideal as a gas producer, but also ideal as a power generator. With it there can be nothing corresponding with shortness of steam, no risk of exploding boilers, no black smoke and no costly stoking. Blast furnaces are stoked by machinery of simple and cheaply worked description. They clear themselves of ash and clinker automatically on the opening of a tap hole. Economy in working is therefore secured. Moreover all the cost of working is covered by the prime product, pig iron: the gas is almost thrown away. There is yet another aspect of the case. The production of a furnace is increased by heating the air blast, and this is effected by burning some of the waste gases in a stove through which air is blown to the tuyeres. By abolishing the hot blast, or using it only at such moderate temperature as can be secured by using the temperature of production of the waste gas, not its heat of combustion, the iron produced can be of the superior cold blast variety, and will fetch a better price. That is to say, where gas can be sold at anything over cost price, it will matter less how much iron is produced per ton of fuel, a consideration now of importance, which at times leads managers anxious to economize to starve their pig. The main fact to notice is that after using fuel for producing iron there is still so much potentiality of energy remaining in its waste gas that when used in the gas engine it will produce more power than if the fuel were burned under steam boilers. This, of course, is due to the higher measure of efficiency of the gas engine as compared with the steam engine.

The following list of furnaces about a year ago in the various iron producing centers may be of interest:

District.	No. of furnaces.
Lancashire	16
Cumberland	17
Lincolnshire	19
Northamptonshire	8
Leicestershire	4
Derbyshire	18
South Yorkshire	12
West Riding	8
North Yorkshire	68
North Staffordshire and Shropshire	20
South Staffordshire	19
Worcestershire	4
South Durham	15
North Durham	11
Barrow	24
Flint	8
Glamorgan	8
Monmouth	19
Ayrshire	46
Lanark	44
Stirling	4

For a country using so much power as Great Britain there are no falls of water of any practical utility, unless we except the much debated Foyers and one or two others. Even if there were it is certain that the capital expenditure necessary to utilize them would exceed many times the expenditure necessary to use blast furnaces. Thus in South California, where several very important power installations have been constructed for transmitting water power about 30 miles, it appears that the initial cost is from £15 to £40 per horse-power, and there is no frost of any serious amount to deal with. Frost is almost fatal to the economical use of small water powers, but it is no difficulty in the case of gas power. A glance at the situation of iron producing centers on a map will show that within 30 miles of each there is a large field for power. Indeed at 30 miles radius many of the centers named would overlap in parts of their districts. The towns of the north, especially of the West Riding, are many of them badly connected by railways, and the manufacturing districts generally afford a huge field for electrical traction, which with so cheap a source of power ought to be a magnificent success. To talk of the decay of trade because of foreign competition is ridiculous in view of the great margins for economy which we possess in this country.

With electrical transmission, power can even now be carried 100 miles with say a loss of 30 per cent., and we may hope to secure better results when the magnitude of the undertakings permits a more liberal use of copper in the lines and higher voltages become practicable. The possibilities of power from blast furnaces are not realized yet in the minds even of engineers. The project is voted visionary by men to whom it is first broached. To such as these an inspection of the plant at Wishaw or at Frodingham would be more impressive than a year's persuasion. The details are so simple there is really nothing to understand; simply a gas propeller, a filter, a holder, and the engine and dynamos. Mr. Thwaite has been remarkably successful, perhaps, because in his demonstration plant he has everything made good and solid, and leaves nothing to chance as good enough for experiment. The plant inspected by the writer was well and carefully made, and its duty was visible in the illumination it afforded to the works. That the system will greatly forward the interests of electric transmission there can be very little doubt in the mind of anyone who will carefully consider the question with a map marked for population and for numbers of furnaces. According to the use made of the gases for hot blast and for working the blowing engines at a high or low pressure, so will the volume of gas for external purposes be more or less, but from 5 to 10 horse-power of continuous power may be expected from each ton of coal per week. Thus a small furnace of 500 tons fuel consumption would yield from 2,500 to 5,000 horse-power for continuous use. The importance of saving this power which now goes to waste cannot be over-estimated.

An Electrical Governor for Marine Engines.

Electric governors for marine engines are now being tried by Italian engineers. In one form recently invented mercury is depended on for communicating the effects of the rising of the propeller out of the water. There are two mercury vessels communicating with each other. When the ship rolls and the propeller rises the mercury runs from the one vessel to the other and cuts out a number of resistances connected to contact pins which pass into the space above the mercury contained in the vessel near the bow of the ship. This causes the current round a pair of electromagnets to increase, and the valve, being under the control of the electromagnet, closes gradually. When the bow rises the resistances are brought in again one by one and the circuit of another electromagnet is closed. This electromagnet also controls the valve and it is opened. When the keel is level no current goes through the electromagnets.

A New Provincial Electrical Association.

The Maritime Electrical Association held its first convention at Halifax, N. S., on the 28th ult. Among the papers read was one proposing to substitute electrical gong buoys for automatic and whistling buoys for purposes of navigation on Canadian coasts.

ON THE ELECTROLYTIC CORROSION OF WATER AND GAS PIPES BY THE RETURN CURRENTS OF ELECTRIC TRAMWAYS.*

BY DR. J. A. FLEMING, F. R. S.

The subject of pipe corrosion by the earth return electric currents of electric tramways has at various times attracted a considerable amount of attention. There is no need to refer to the experience gained in the early days of electric traction, chiefly in the United States, which impressed on engineers the necessity for proper and efficient bonding of the rails in those cases in which they act as the return circuit. The British Board of Trade regulations now in force, under which electric traction is at present conducted in the United Kingdom, prescribe precisely the conditions for the use of uninsulated metallic return circuits which are intended to prevent injurious electrolytic action on subterranean pipes. Among these rules an important one is the sixth regulation, in which the maximum permissible potential difference which may exist between a pipe and a portion of the neighboring rail return is stated. In the case of an overhead electric tramway working with an earth return in which the current returns to the generating station by the bonded rails assisted or not by return feeders, an electrical survey made, when cars are running, by measuring with a voltmeter the potential difference between the rails and any pipes buried in the earth in the neighborhood, generally will reveal certain districts over which the tram line rails are positive to the buried pipes in their neighborhood, that is, are at a higher potential. Certain other regions, usually near the generating station, will be discovered in which, on the other hand, the pipes are positive to the rails. The Board of Trade sixth regulation (ii) is as follows:

"If at any time and at any place a test be made by connecting a galvanometer or other current indicator to the uninsulated return and to any pipe in its vicinity, it shall always be possible to reverse the direction of any current indicated by interposing a battery of three Leclanche cells connected in series if the direction of the current is from the return to the pipe, or by interposing one Leclanche cell if the direction of the current is from the pipe to the return."

The above translated out of official language signifies that if the pipe is negative to the rail the potential difference shall not exceed 4.5 volts, and if the pipe is positive to the rail the potential difference shall not exceed 1.5 volts.

No matter what difference of potential may exist between a pipe and a neighboring rail it is well understood that electrolytic corrosion or damage can only ensue at any place under two conditions:

(1) The potential difference must create an electric current which leaves the pipe at that place; and (2) the conduction through the surrounding soil, or at least into it, which thus takes place must be electrolytic in character.

Hence, generally speaking, the danger areas are those in which the pipes are positive to the rails and where a resulting current flows out of the pipe into adjacent electrolyzable soil. Assuming then that the Board of Trade regulations are obeyed, the chief question of practical interest at present is to determine whether under normal conditions of working a potential difference of less than 1.5 volts between a pipe and the nearest part of an earth return, the pipe being positive to the return rail, is sufficient to cause an injurious action on the pipe by the production of electrolytic erosion. The matter is certainly largely determined by the nature and amount of the electrical conduction which can take place through ordinary soils, especially those which form the subsoil in towns and cities. Information has therefore been collected on this matter, and an experiment made in my laboratory with London clay taken from an opening in a London street made for laying down pipes, on December 14, 1897, gave the following results: The clay was packed into a dry, well-varnished wooden box, the interior measurements of which were: depth = 27.3 cms., width = 18.0 cms., length = 61 cms. Two clean sheet-iron plates were placed at the ends of the box, the dimensions of each plate being nearly as possible equal to the cross-sectional area of the column of clay. Wires were soldered to these plates. The resistance of the mass of clay, 61 cms. in length and 491.4 sq. cms. in cross section, was found to be 194 ohms when measured with proper precautions in the usual way with the Wheatstone bridge and two dry cells. Keeping this electromotive force applied the resistance soon rose to 277 and then to 283 ohms, indicating a progressive polarization of the plates and therefore an electrolytic conduction. A checking measurement was made also with the potentiometer and it was found that a potential difference of 100 volts, created between the plates, produced a current of 0.52 ampere through the column of clay, thus indicating a total resistance of 194.5 ohms. These consistent figures show that the resistance of the clay in its then condition of moisture was approximately 1,566 ohms per centimeter cube, or nearly 17 ohms per yard cube.

The resistance proved, as might be expected, to be immensely dependent on the state of the clay as regards moisture, greatly increasing as the clay dried up.

A mass of damp sand, moistened with water slightly salt, was found to have a resistance approximately of 1 ohm per yard cube.

Experiments by Dr. St. Lindeck* at the Reichsanstalt in Berlin in 1896 showed that cement blocks after immersion in water for 22 hours had a minimum electrical resistance of about 14 to 15 ohms per yard cube, but in their normal state a resistance of about 50 ohms per yard cube, and when especially dried by heating for 5½ hours to 100° C. a resistance of nearly 270 ohms per yard cube. The same investigator found that concrete (one part cement and five parts gravel) after being immersed for two hours in water had a minimum resistance of about 25 ohms per yard cube, but after being artificially dried for 4½ hours at 100° C. its resistance was of the order of 500,000 ohms per yard cube.

It has been frequently stated that concrete is a very bad conductor or fair insulator, and that rails laid on it are practically insulated, but the considerable decrease which takes place in the electrical resistance of materials such as clay, cement, concrete, sand and various soils, when impregnated with moisture, and the great increase which takes place when they are artificially dried indicates that the conduction through them in their normal condition is largely due to the presence of water, and must, in great part at least, be electrolytic in character.

In the average condition of moisture most of the materials forming the subsoil in town and city streets are not likely to differ much in conductivity from the sample of London clay, damp sand or cement, tested as above described, and will probably have a specific resistance between 15 and 30 ohms per yard cube. Although the above specific resistance is large compared with that of metals, being of the order of 1,000 million times that of copper, yet between extensive metallic surfaces buried in the soil, the actual total electrical resistance may be numerically very small. Between two 100 yard lengths of 6 in. clean iron pipe placed in clay ground a yard apart, and, say, 2 ft. deep, the actual measured resistance would in general be something of the order of 1 ohm. It is clear, therefore, that a continuously-applied voltage not exceeding 1.5 volts may cause the flow of very considerable quantities of electricity in the course of time between metallic surfaces of large area buried in the soil. Moreover, it is evident that a not inconsiderable portion, and perhaps the whole, of this flow, must be carried by electrolytic conduction. In any case, whatever may be the nature of the actual roadbed on which the rails rest the conduction out of the pipe will be in part electrolytic, if the pipe itself is in contact with ordinary soil. Under these circumstances the anode or pipe will be electrolytically attacked. Suppose that two iron plates or surfaces are placed in sand moistened with water, and having in it electrolyzable salts the acid radicles of which can attack iron. Let a current be made to flow from one plate to the other by creating a potential difference between them, then the passage of one ampere-hour out of the positive plate will remove or dissolve off from that plate 0.6968, or, say, 0.7 of a gramme of iron if the metal is removed in the ferric state, or 1.04 grammes if in the ferrous state. Since there are 453.59 grammes in one pound (avoirdupois), and since the specific gravity of iron is about 7.8, it is easy to see that one cubic inch of iron may be removed from the positive plate by the electrolytic passage out of it of some electric quantity between 127.7 and 182.5 ampere-hours. This is, very roughly speaking, *one ampere-week*. The iron so electrolytically removed may pass either into soluble iron salts, or may remain as an adherent layer of hydroxide. If chlorides, sulphates or nitrates are present in the soil, the iron may be removed partly as ferrous or ferric salts which may be diffused through the surrounding soil, or wholly or in part converted into insoluble and adherent ferric hydroxide by secondary reactions. It is important to know what is the least voltage which will effect this electrolytic corrosion. If the surrounding soil is of a nature to favor electrolysis, that is, if moisture and salts are present in it, a far less difference of potential than the maximum of 1½ volts permitted by the Board of Trade can produce rapid corrosion of an iron anode or plate. To illustrate this fact the following experiment was tried: Two plates of sheet iron were placed in a porcelain box filled with sand slightly moistened with salt water. The plates were kept at a difference of potential of 1 volt and at such a distance apart that a current of 1-20th of an ampere passed between them. At the end of ten days the positive plate was very much corroded; the negative plate not at all. It has been found that the actual weight of iron removed may very much exceed the electro-chemical equivalent of the current passed, due, no doubt, to local action. This is shown by the following experiment: Two iron plates were cleaned and weighed previously to being used, and then placed in moist sand containing a little salt. The plates had an immersed area of 11.4 square inches and were 4.25 inches apart. A difference of potential of 1.5 to 1.8 volts was maintained between them for 23¼ hours. At the end of this period the positive plate was weighed and found to have lost .039 of a pound or nearly two-thirds of an ounce. The electric quantity passed was only 8.14 ampere hours. Theoretically this quantity should have removed from 6 to 8 grammes, or nearly one-fourth of an ounce from the positive plate. The actual loss was nearly three times that amount, and the excess is probably accounted for by the great local action taking place on the iron plate when oxidized in patches and placed in an electrolyte, the acid radicle of which is capable of forming a soluble salt of iron.

In a paper read by Mr. I. H. Farnham before the American Institute of Electrical Engineers in 1894 (see *The Electrician*, Vol. XXXIII, p. 16), it is stated that some of the worst cases of pipe corrosion in Boston, U. S. A., occurred when the potential difference of the pipe and rail was only 1.5 volts.

Mr. A. T. Wells of Chicago, in mentioning some cases of cable corrosion which occurred in Cincinnati, stated that the potential between the rail and cable

* Paper read before the British Association at a joint meeting of Sections A and G, Bristol, Eng., Sept. 12, 1898.

* See *Electrician*, Vol. XXXVI, p. 788; also *Electrotechnische Zeitschrift*, March 19, 1896.

was never more than one half, and usually less than one quarter of a volt.

Mr. J. C. Lee of Boston states he has experimentally caused the corrosion of lead and iron by a difference of potential of one-hundredth of a volt.

I have myself produced in a few days sensible erosion of an iron anode placed in moist sea sand, the difference of potential between it and an iron cathode being less than half a volt and the current passing only .03 of an ampere.

These experiments and others of a like character showed that quite small potential differences—much less than 1 volt—between iron surfaces buried in damp soils, especially if soluble chlorides are present, may bring about considerable electrolytic erosion in not very great periods of time, and that there is no absolute security in the limit of 1½ volts as imposed by the Board of Trade, sixth regulation (ii). It was felt desirable to try an experiment on a somewhat larger scale and with actual water pipes buried in the soil. At my suggestion Mr. H. W. Pearson, the engineer of the Bristol Water Company, has carried out at the Bristol waterworks, at Chelvey, an experiment of the following character:

Three rows of new ordinary cast iron 5 in. water pipe were laid down in the ground, one yard apart. Each row consisted of four lengths of 9 ft. pipe, or 36 ft. in all. The lengths were jointed in the usual way with lead and the ends of the lengths were capped with cast iron caps. In each pipe length was screwed a wrought iron rod about 2 ft. 6 in. in length.

These 36 ft. lengths of pipe were buried in the ground 2 ft. deep, just as if they were actual water pipes in use. The ends of the iron standards projected above the ground, and enabled an electrical connection to be made with the pipes at any length. The pipes when buried were clean new cast-iron pipes. Arrangements were then made to keep two adjacent rows of these pipes at a difference of potential of 1 volt night and day for six months. This was achieved by the use of a couple of large secondary cells charged alternately, and which were connected through an adjustable resistance with the two adjacent rows of pipes. A low reading ammeter and voltmeter was provided. The experiment was started on March 1, 1898, and continued for six months. Daily readings were taken of the voltage between the pipes, the current passing between the pipes, and the nature of the weather. The electrical arrangements were placed under the charge of Mr. H. T. Sully.

The arrangement was then as follows: One row of pipes was neutral and simply laid down for comparison to observe the normal appearance of the pipes at the conclusion of the experiment. The other pair of pipes had a difference of electrical potential of 1 volt maintained between them constantly. All three rows of pipes were otherwise under similar conditions and buried in soil of the same kind, a non-acid nearly neutral loam or sandy clay. The average current passing between the two active pipes was 0.15 of an ampere, and varied only between 0.1 and 0.2 of an ampere during the whole of the six months. At the end of the six months the pipes were opened up and carefully examined. The appearance of the pipes was very different. That pipe length which had been connected to the negative pole of the cell was a clean, gray color and had scarcely any trace of oxidation on it. It closely resembled the appearance of the pipe when first put in. The pipe length which had been connected to the positive pole of the cell was uniformly covered with a layer of orange-yellow oxide or hydroxide of iron, in some places of quite sensible thickness and easily detached. The pipe which had been neutral was oxidized slightly in places, but by no means uniformly. The experiment lasted 4,416 hours and 662 ampere-hours had passed from one pipe to the other under a constant voltage difference of 1 volt. The appearance of the pipes clearly indicated that electrolytic action had taken place. In the case of the negative pipe the clean appearance suggested that electrolytic hydrogen had been liberated against it and preserved it from oxidation by contact with the gases, water and salts in the soil. In the case of the positive pipe electrolytic action had clearly assisted or created oxidation. No actual perforations or pitting was found on the positive pipe, probably by reason of the fact that the electrical connections were so made as to facilitate as far as possible a uniform electric flow from one pipe to the other, not specially localized in one place. The actual electric quantity passed, viz., 662 ampere-hours, is theoretically equivalent to the removal of about 3.5 to 4 cubic in. of iron. Since the pipe had a length of 36 ft. and a diameter of 5 in., its surface is approximately 6,500 sq.in. or 45 sq. ft. Hence the oxidation of a comparatively small thickness of the iron uniformly all over the pipe would, electro-chemically speaking, account for the electric quantity passed. The difference between the two pipes amounted in effect to a greater rate of "ageing" of the positive pipe. It is, however, certain that if the electrolytic action, which in this case was tolerably uniformly diffused over the whole pipe surface, had been concentrated at one particular place the erosion would have assumed a more serious aspect.

In the above described experiment none of the conditions served to direct the exit of the current to one limited area on the positive pipe.

It is obvious that if under any conditions of electric traction there are differences of potential between the portions of a continuous pipe buried in the earth, the production of a current of conduction, and therefore perhaps electrolytic erosion, is dependent upon the longitudinal conductive power of the pipes themselves. It has been stated above that ordinary subsoil resistance may be something of the order of 10 to 50 ohms per yard cube. The specific resistance of cast iron is about 100 microhms per cubic centimeter, and would therefore be not far from one-millionth of an ohm per yard cube. It is, therefore, very easy to see that if it were not for the resistance introduced at the joints of the pipes and at the surfaces by rust or oxides, the conductivity of a cast-iron pipe would always be much greater than that of the soil which it displaces.

The resistance introduced, however, by bad or oxidized contacts, or by films of moisture, paint or preservative compound may altogether overbalance or outweigh the resistance of the mere run of the pipe material. I calculate that if there were no joints at all the electrical resistance of a 5 in. cast-iron water pipe would be about 1-50th of an ohm per 100 yards, or say 1-3d of an ohm per mile. If leaded junctions are made in the usual way between fairly clean surfaces the joint resistance may not be large. In the case of the pipe experiment above described, made at Chelvey, I measured at the end of the six months the total resistance of 27 ft. of the 5 in. cast-iron pipe which had been the negative pipe. This length included two leaded joints. The whole resistance was found not to exceed 1-25th of an ohm.

It is obvious, however, that no general statements can be made. It is a matter of great difficulty to measure the resistance *per se* of a pipe buried in the ground, and it is probable that, whereas in some cases the conductivity of long lengths of water and gas pipes may be fairly small, in other cases oxidized or electrically bad joints will introduce great resistance.

We have, however, to regard the subterranean pipes of all kinds as forming a network of conductors, interrupted more or less at places by junctions of high resistance but, on the whole, most probably forming an irregular conductor system of greater conductivity than the soil or earth actually displaced by it or which would occupy the same space if the pipes were not there.

(*To be continued.*) p. 214

EQUIPMENT AND MAINTENANCE OF ELECTRIC CARS.*

BY M. S. HOPKINS.

(*Concluded from page 184.*)

MOTOR BEARINGS.

Bearings should be run "close" at all times, and the time of their renewal should be determined by the effect of the wear on the gear and pinion, as the wear on these parts is largely affected by the wear of the bearings.

After a series of tests covering quite a period of time, as to the wear of various materials used in motor bearings, the writer feels warranted in making the statement that under the ordinary conditions either the best grade of babbitt or brass bearings should give a longer life than six months, and when a bronze bearing of the proper mixture is used and properly lubricated a life of twelve months can safely be expected. The method of lubrication largely affects the life of brasses. After long tests with various lubricants the writer has discontinued entirely the use of grease on armature brasses, and in most cases on axle brasses, a good grade of engine oil, supplied through wicks, being more satisfactory and economical.

In order to reduce the maintenance of brasses to a minimum the use of phosphor bronze is strongly recommended. Street railways operating twenty-five or more cars will find it economical to cast and machine their own brasses. This may be discouraging to the supply men, but it means money on the right side of the ledger when the expenses are footed up. A small brass furnace can be erected cheaply, and after suitable jigs, which can be attached to any lathe, have been provided for boring and turning, the cost of casting and boring is very little more than the cost of rebabbitting especially where babbitted brasses are machined after boring, while the life of the bronze bearing is far in excess of that of any babbitt yet tried.

Rough and burnt commutators are too frequently cause of expensive motor repairs, and usually indicate imperfect motor design or inexcusable neglect. Well designed motors in good condition, even under the hardest service, should not require turning oftener than once in eight months, provided, of course, the average work is within the rated capacity of the motor. There is nothing that so well indicates to the practical man the condition of the motor as the condition of the commutator. Whenever the commutator shows signs of burning or blackening, steps should be taken at once to prevent it. It is not advisable to try to prevent this by the continual sanding of commutator by motor inspectors, though the occasional cleaning up of the commutator with sand paper is necessary with all motors. The causes of trouble of this character are so numerous that mention is made of only a few of the more important.

The kind of brush used is an important factor. Brushes should be of soft, close-grained carbon treated with a good lubricating compound—one which does not flow too freely from the heat from the motor, and which will not burn and carbonize on commutator. The price of the brush is not a material consideration, as a brush which is slightly superior to another will prove economical even at quite a large increase in first cost. As a rule the tension on the brushes of railway motors is too light. It is a common belief that heavy tension causes wear of the commutator, but experience has shown that the actual wear of commutators, due to the friction of the brush, is very small, and that in some cases increased tension will materially decrease the sparking, which causes the greatest wear. Improper alignment of brush-holders also frequently causes sparking. In

* Read at the Convention of the American Street Railway Association, Boston, Sept. 6-9, 1898.

recent practice the use of side contact springs on brushes has been generally abandoned. On motors carrying heavy currents this spring is quite essential as the excessive heating of the brushes is caused by limited contact in the holder.

Commutator insulation should be made of what is known as the built-up mica segments of the very softest grade of amber mica. A hard, clear mica should never be used in the commutator, as this mica will not wear away as fast as the copper, and there is nothing so disastrous to the life of the commutator as high mica insulation.

In some motors it may be necessary to change the winding of the armature and field coils in order to avoid the burning of the commutator. First, determine by actual experiment what change in winding is necessary, and then equip with the new, winding every armature or field that comes in burned out. The change can thus be made without any great expense, as the greatest part will be borne by the maintenance charge.

THE ELECTRICAL TESTING OF RAILWAY EQUIPMENT.

Elaborate systems for the periodical testing of insulation on railway equipment seems to be growing in favor with some electrical engineers, but the practical value of these elaborate tests is not fully demonstrated. Experience has shown that tests of this kind are very misleading and frequently cause the tearing down of equipment which, under ordinary conditions and had no tests been made, would have continued in service for a long time.

Judging from my own experience, it is neither necessary nor advisable to test periodically the insulation on the equipment, but to make such tests only in cases where the motors are not working properly. The proper training of motor inspectors as to the little points about railway equipment which clearly indicate trouble with motor, will locate in nearly all cases trouble due to weak insulation, so that it can be remedied before any serious damage has resulted to any other part of the equipment.

All armatures and field coils repaired should be carefully tested as to resistance and insulation to ground, and on all armatures having coils repaired, new commutator put on or commutator turned, the resistance between commutator bars should be very carefully measured. This should be done preferably with a portable Wheatstone bridge testing-set capable of showing clearly a variation in resistance of 0.001 ohm. This is one of the most important tests to be made in the care of railway equipment, as more burnouts of armatures are caused by the slight short-circuiting of coils, due to the bridging over of insulation between bars by solder, acid or copper turnings under the leads, than from any other cause. These defects can be located only by a test of this kind. A bad joint or any mistake in connecting up the leads will be detected at once before any damage has been done. For testing insulation to ground I consider a first-class magneto of 10,000 ohms resistance all that is necessary.

TRUCKS.

As the design of trucks varies so widely, very little can be said in a paper of this kind as to the detail of truck maintenance other than to say that all joints should be kept perfectly tight, and where they do become loose the parts should be swedged out and refitted. All bolts should fit tight, and the nuts should be secured by lock washers. In the opinion of the writer, soft, gray iron inset with plugs of soft steel has never been equaled for shoe brakes. The material giving the greatest amount of friction against a chilled surface should always be used, regardless of cost.

Much has been written of late on the subject of car wheels, their wear and alignment, and still street railway managers are careless about their wheels. Too much care cannot be given to the sizing and alignment of wheels and the pressure with which they are forced on the axle. At least 50 per cent. of the wheel renewals throughout the country are caused by broken or sharp flanges or a broken wheel. The use of sand influences largely the life of wheels, but the conditions vary so widely that I would not be justified in saying that in no instance should a sand box be placed upon a car. I will say, however, that where it is possible to successfully operate without them sand boxes should be discarded and other means used for sanding the track. In most cases it is far more economical to fit up a special car capable of carrying a large amount of sand, and sand the track for, say, 100 feet before each point where a stop is likely to be made and on grades and in places where the track is exceptionally slippery, than to sand the rail for its entire length.

REPAINTING OF CARS.

The experience of the writer has clearly demonstrated that it is satisfactory to repaint cars without removing all of the old paint. Patent varnish removers, scalers, etc., are a snare and a delusion. The writer has found the following system of repainting cars to be quite satisfactory: First remove all old paint by softening it with a blow-pot just enough to allow it to be scraped off with a broad putty knife, not allowing flame from the blow-torch to strike the bare wood at any time. Then sand off the surface well with block and sand paper. Where any new work has been put in it should be first primed with a coat of boiled oil and a little lead and allowed to stand for not less than four days. Dashers and all iron work should be thoroughly cleaned with strong alkali and primed with a coat of linseed oil put on boiling hot and allowed to thoroughly harden, giving one coat of oil and lead before color. If the surface is rough, plaster with lead on this coat. Then allow it to thoroughly harden and sand with block; then lay on two coats of flat lead, two coats of color, color varnish, stripe and ornament; finish with one coat of rubbing varnish and one coat of finishing varnish. The main object in the painting of cars should be to secure a hard, smooth surface which will hold out the varnish with the very smallest amount of material; the thinner this surface is the better. Care should always be taken where plaster is used to make it as thin as possible, and lead coats, color and varnish should all be carefully tempered, so as to set alike, as most cases of cracking of paint are due to the want of proper tempering of lead and color coats.

A car painted in this manner should not require repainting for from six to seven years if properly cleaned and varnished. Cars should come into the paint shop, even where the best grades of varnish are used, once every eight or ten months and be washed thoroughly with pumice and strong soap and given a coat of finishing varnish. The life of varnish depends largely on the care given to the cars in the cleaning department. Cars should be sponged off daily with clear water, and any accumulation of dirt removed as far as possible by the use of a chamois skin and sponge—care being taken to rinse off the grit before rubbing with sponge or chamois. Once every thirty days the car should be thoroughly washed down, using a good grade of soap. If it is impossible to remove dirt and stains from the surface of the cars with the finer grades of soap, strong soap may be used, it being found that the injury to varnish resulting from the use of this soap once every thirty days will be more than offset by the saving in cleaning and touching up when the cars are taken into the paint shop for revarnishing.

In the selection of designs for painting of cars the plainest and neatest design should be selected as a rule. No lettering should be done on the panels, as this increases greatly the cost of maintenance in the paint shop department. In all cases the signs should be put upon sign boards made especially for the purpose.

The inside of the cars should be cleaned thoroughly and rubbed down with pumice stone every second time the car comes into the paint shop to be revarnished. There are a number of so-called car cleaners on the market which are rather a detriment than an advantage to the outside surface of the cars, but which may be used to advantage on the interior of the cars, especially around the sash. Special observation of the interior of cars will show that the varnish commences to disappear first around the sash—moisture from the windows gathering around the molding which holds the window sash, first discoloring it and gradually working into the sash itself. A car cleaner which is made up largely of oil and dryer, if used about once a week on the window sash and molding, will be found to be a great advantage. Three years ago four new cars were selected, and a car cleaner used weekly on the windows of these cars, and to-day not a stain is to be seen on sash or molding, the cars having been revarnished twice during that time.

After a number of trials of various floor paints and paints mixed especially for the purpose the conclusion has been reached that there is nothing equal to pure white lead and linseed oil and suitable color for the floors of all cars. The majority of car floors are stripped, and it has been found impossible to find any material hard enough to stand on the top of the strip of a car floor, while almost any material will stand the wear, but not the moisture, between the slats. It is very evident, therefore, that the best paint for this purpose is one which will best preserve the wood in the floor of the car from the constant moisture to which it is subjected.

As to the car roofs, the main object is to put as little material as possible on the canvas of car roofs, and that material should be elastic and yet withstand the action of the weather. Great care should be used in tempering of paints for roofs. Avoid painting the roof one time with one kind of paint and the next time with another, for in the long run this will invariably crack and require the renewal of the canvas on the roof. In a number of cases it is customary to use slush or any old thing which happens to be in the paint shop for painting roofs of cars. This is a great mistake, for no paint is too good for the car roof—the best white lead and oil giving the best results.

Unquestionably the truck of car should be painted with a good grade of lead paint, as it prevents rust, decreases renewal of bolts and adds greatly to the general appearance of the car. A handsomely painted car body mounted on a dingy, rusty-looking truck has a half-finished appearance, to say the least.

Magnetism and Temperature.

Mr. J. R. Ashworth, B. Sc., in a paper read before the British Association, "On the Construction of Magnets of Constant Intensity under Changes of Temperature," describes experiments on a remarkable property of drawn steel wires. Magnets made of such wires, after a series of heatings and coolings, reach a cyclic state in which, contrary to general experience, an increase of temperature produces an increase of magnetic moment, and decrease of temperature a decrease of magnetic moment. It is easy, by several processes which are described, to change this abnormal effect to the normal one, in which higher and lower temperatures produce lower and higher magnetic moments respectively. In passing from the abnormal to the normal state by any of these processes, a stage is reached at which change of temperature neither increases nor decreases the magnetic moment, and for changes within the atmospheric range of temperature, the intensity of such a magnet remains constant. An account is given of the behavior at different times of magnets of constant intensity which have been tested at intervals during eighteen months. In conclusion, experiments on the cause of the abnormal thermo-magnetic effects are described.

AMERICAN STOKERS AT UNION STATION

Edison Electric Illuminating Co., Brooklyn, N. Y.

Among mechanical stokers and patent furnaces, the American stoker, introduced by the American Stoker Company, Washington Life Building, New York City, stands alone as a practical exponent of the principle of underfeeding of coal. That it is built upon attractive lines is evident from its wide and rapidly extending adoption in power plants of prominence and magnitude in all parts of the country.

The principle upon which the American stoker operates, practically reducing the coal to gas and coke, insures complete combustion, and guarantees entire freedom from smoke and soot. It will burn any grade of coal from the finest slack coal to lump of any size that can be fed into the hopper, the constant feeding doing all the stoking necessary.

A good example of the efficiency of the American stoker is found in its use at the plant of the Edison Electric Illuminating Company, Brooklyn, N. Y., which is destined to be one of the largest electrical power plants in the world, plans having been made for a 60,000 horse power station, and about one-fourth of the plant has already been completed. The boiler room, 198 x 46 feet, is equipped with boilers of the Cahall water-tube type, each with a nominal capacity of 500 horse power. The boilers are furnished with the American under-feed stokers, three stokers independently driven being installed for each furnace.

Slack coal for the furnaces is received upon boats at the foot of a dock and carried by cars to storage bins. From these bins it is elevated to smaller bins just above the boiler floor, and from these distributed through chutes to the several conveyors carrying it to the stokers. Chutes leading from the boiler house bins terminate in a weighing apparatus which automatically registers the amount of coal passing through.

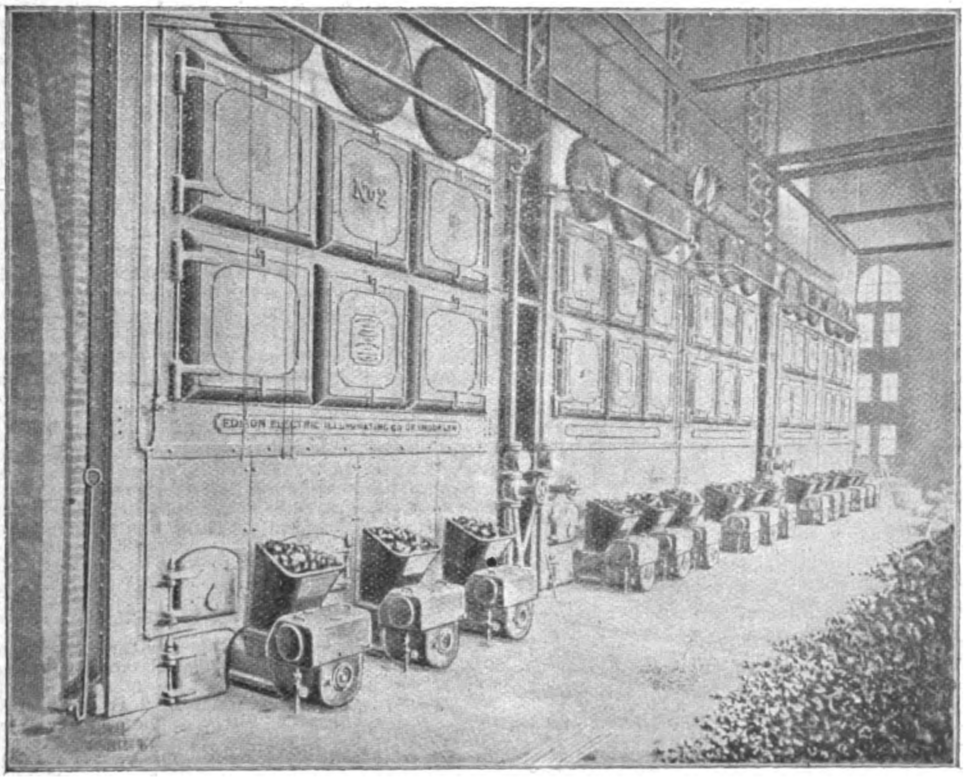
The illustration herewith, showing the boilers and stoker arrangement, was secured before this coal conveying apparatus was installed.

Passing through the weighing apparatus the coal is distributed by two conveyors to three mechanical stokers on each side. These conveyors are driven by an electric motor located on the upper front edge of the boiler front. Immediately beneath the coal hopper of the stoker is a conveyor pipe which communicates with the coal magazine placed in the furnace of the boiler. A screw conveyor, or worm, is located in the conveyor pipe and extends the entire length of this magazine. Immediately beneath the conveyor pipe is located the wind box, having an opening beneath the hopper, and through which the air supply for the furnace is forced. The other end of this wind box opens into the air space between the magazine and outer casing. The upper edge of the magazine is surrounded by tuyeres, or air blocks, which are provided with openings for the discharge of air inwardly and outwardly.

Each stoker is driven independently by a small steam motor attached to and located in front and beneath the hopper. The motor has a simple reciprocating piston which is so connected as to turn the conveyor shaft which forces the coal into and up through the magazine.

The stoker is entirely self-contained and complete in itself. The rate of feeding the coal is controlled by the speed of the motor, this being effected by the simple means of throttling the steam in the supply pipe to the motor. The coal fed into the hopper is carried by the conveyor into the magazine which overflows on both sides and spreads upon the sides of the grates. The coal is fed slowly and continuously and approaching the fire in its upward course is slowly roasted and coked. The gases released from it are taken up by the fresh air entering through the tuyeres, which consumes these gases and delivers the coal as coke on the grates above. Every pound of coal fed into the hopper is subjected to this gas making process, and there is no loss of coal through grates by reason of the use of dead grates in the furnace in place of open grate bars.

The complete combustion produced by this method is appreciated when viewing the stack of the plant, from which there is no smoke.



American Stokers at Union Station, Edison Co., Brooklyn, N. Y.

The Chicago Electrical Association.

Below will be found the Fall programme for 1898 of the Chicago Electrical Association. The meetings will be held at 1736-41 Monadnock Building:

October 7, 1898—"Electrical Features of the Late Spanish-American War," by Thos. G. Grier, Western Electric Co.

October 21, 1898—"Practical Points on Electrical Measurement," by W. B. Hale, Cable Testing Department Western Electric Co.

November 4, 1898—"The Electrical Equipment of a Model Printing Establishment," by George A. Damon, Electrical Engineer with B. J. Arnold.

November 18, 1898—"The Development of the Motor-Cycle," by F. B. Rae, Electrical Engineer.

December 2, 1898—"Practical Points in Street Railway Engineering," by W. A. Harding, Master Mechanic and Electrician Calumet Electric Street Railway.

December 16, 1898—An address by Arthur V. Abbott, Chief Engineer Chicago Telephone Company, on "Wireless Telegraphy" (illustrated by apparatus).

January 6, 1899—"Telephone Engineering—Some Problems, Solved and Unsolved," by S. G. McMeen, Chief Engineer Central Union Telephone Co.

January 20, 1899—"Observations on Ventilating Fans," by Gerard Swope, Western Electric Co.

The officers of the Association for 1898—are F. S. Hickok, President; T. G. Grier, Vice-President; E. J. Swartout, Treasurer; J. R. Cravath, Secretary; S. G. McMeen, J. M. Hollister, C. Wiler, directors.

LEGAL NOTES.

Judge Swan of the United States District Court at Detroit, Mich., has just decided that the lapsing of a foreign patent after the filing of the application for a United States patent, but before its issuance, does not affect the term of the subsequent United States patent.

In the infringement suit brought at Detroit by the Sprague Electric Motor Company against the Detroit Citizens' Street Railway Company, Judge Swan has issued an order for a preliminary injunction restraining the railway company from using the motor alleged to be an infringement of the Sprague patent. Another order issued by the Judge suspends the injunction long enough to enable the railway company to remove the apparatus from its cars. Within 30 days 250 must be removed, within 60 days 250 more, and within 90 days the balance. Sworn statements are required at the end of each of these periods that the work has been performed as ordered.

CANADIAN NOTES.

It is reported that Edward S. Jennison, a Chicago engineer, has a plan to dam the Kakabeka river at a cost of $1,000,000 and to utilize its power for the benefit of Port Arthur and Fort William, Ont. The intention is that the towns of Port Arthur and Fort William shall get their water supply from this source, which will likewise give them a fire pressure by gravitation. The water will, it is said, be sufficient also to generate electricity to supply power to the Port Arthur electric railway as well as electric light and energy to both towns.

Application has been made to the Ontario Legislature for an act to incorporate the Toronto Elevated Railway Company, such act to provide that the company may, subject to the consent of the municipalities affected and subject to all other existing rights, construct and operate a system of elevated electric railways in Toronto and adjoining municipalities, and also in conjunction therewith a system of surface railways in Toronto and other municipalities within a radius of 50 miles.

The annual meeting of the Standard Light & Power Company was held this week at the office of the company in Montreal. The annual report of business for the past year was considered highly satisfactory, being the most successful year since the company's incorporation. A contract has been entered into with the Lachine Rapids Hydraulic Company for supplying current to run their plant from the Lachine Rapids in place of steam. It was decided to largely improve the station by purchasing rotary converters, fire proofing the building and making the station the most complete direct current station in the Dominion. In addition to receiving power from the Lachine Rapids, there is also a magnificent steam plant in reserve, so that their customers are doubly protected.

THE NEWS.

What Is Going On in the Electrical World.

LIGHTING.

Abbeville, S. C.—An electric light plant for this town is being considered by prominent business men.

Charlestown, W. Va.—The directors of the Charlestown Electric Light, Heat & Power Company have, it is stated, decided to purchase a new dynamo for incandescent lighting and will change to the alternating system. Mr. Hostetter has resigned as manager and been succeeded by F. P. Unger.

Clyde, N. Y.—L. L. Moses of the Clyde Electric Company, representing a syndicate, has submitted a proposition to the common council of Geneva to light that city for ten years.

Fredericksburg, Va.—The council has unanimously adopted the report of the committee on light advising the erection of an electric lighting plant by the city. Bids will be asked for and a special election held to get a vote of the people on their acceptance.

Grand Rapids, Mich.—The board of public works has awarded the contract for the complete installation of an electric lighting plant to the Chase Construction Company of Detroit for the lump sum of $89,970.

Herkimer, N. Y.—The municipal commission having sent a communication to the board of trustees requesting the board to call a special election for the purpose of allowing the citizens of the village an opportunity to vote on a proposition to bond the village for $13,000, the money to be used in establishing an incandescent electric light plant, the board in compliance with the request has ordered an election to be held October 10.

Independence, Mo.—W. T. Felton of Kansas City proposes if granted a franchise to put in an electric light plant here and furnish the city with arc lights and a full night service for $90 a year per lamp. The present company charges $75 per light based on a moonlight schedule and shuts off the light promptly at 12 o'clock, leaving the city in absolute darkness.

Milwaukee, Wis.—The council of South Milwaukee has adopted a resolution providing for the purchase of the plant owned by the South Milwaukee Electric Light & Power Company. Payment is to be made in monthly installments until these amount to $19,000, when the company is to deed the plant to the city for $1. This course was rendered necessary because the city is already bonded to the debt limit.

Morenci, Mich.—The village council has accepted the proposition of S. A. Scofield & Sons to light this village with electricity. The firm has a fine electric plant and already furnishes light for nearly all the business places.

Montpelier, Vt.—The Consolidated Lighting Company has added a Stanley dynamo of 200 horse power to its plant. It will be used in furnishing light for the State House.

New York.—The Edison Electric Illuminating Company of New York has issued a circular to its customers announcing a reduction in rates on bills due after October 15. The new rates as stated in the circular will be: 20 cents per kilowatt hour (equivalent to one cent per 16-candle power 50 watt incandescent lamp hour, or 10 cents per standard arc lamp hour) for first hour's daily use; 15 cents for second hour; 10 cents for the third and fourth hour and 5 cents for all use above four hours. For wholesale use, 10 cents per kilowatt hour for the first four hours and 5 cents for all use above four hours, with reduction for quantity. These prices will be made for the period October-December, 1898, with the intention, should results justify, of making them permanent and possibly of still further reducing rates for long-hour use or making a maximum rate equivalent to ¾ cent per 16 CP. incandescent lamp hour. Contracts will be made at the above prices, however, for a full year. Plans to reduce rates for power service are under consideration.

Orlando, Fla.—The electric light company that promised to give Orlando a full fledged plant by May 1 last seems to have met with obstacles. Poles were secured and set for the wires, a building was erected, and now the engine, boiler, dynamos and other machinery are there, but no one to pay the freight and claim the property. It has been claimed that the property has not been paid for, and is still owned by the shippers.

Patchogue, L. I.—The Patchogue Electric Light Company is contemplating the extension of its lines through the Long Island villages of Blue Point, Bayport and Savville. The company at present only supplies the village of Patchogue. Should the plan of the company mature, as it will without a doubt, the company will increase their capital stock from $20,000 to $30,000 in order to meet the expenses of the change.

Port Chester, N. Y.—The Port Chester Electric Lighting Company has just purchased the plant and franchises of the Westchester Gas & Electric Company and will begin in a short time to build an entirely new plant to supply the villages of Port Chester, Rye, Harrison and Mamaroneck. The capital stock of the new company is $50,000, and the officers are William E. Ward, president; J. Addison Johnston, vice-president; William L. Ward, treasurer, and Walter S. Comby, secretary.

Seattle, Wash.—Dawson, Alaska, is to have electric lights this winter. A full plant, including five dynamos and apparatus for operating twenty arc and 2,000 incandescent lamps was taken on the steamer Dirigo that has just sailed for Lynn canal. The outfit weighs thirty-five tons. There is a small outfit already at Dawson, which was expected to be operating 800 incandescent lamps by September 15. G. M. Easterly is the superintondent of the works.

Sturgis, Ky.—An electric lighting plant is to be established here shortly by a local company who propose to put in a system at their works of sufficient capacity to light the town.

Tekoa, Wash.—The electric light plant owned by Frank and Edward Mahoney was damaged by fire on the 20th ult., much of the machinery being rendered unserviceable.

Utica, N. Y.—The Utica Electric Light Company is increasing the capacity of its plant and has ordered two 125 arc light dynamos, a 250 KW. generator and a 1,000 HP. Corliss cross compound condensing engine.

Wharton, Tex.—A company represented by G. C. Gifford has been granted a franchise by the town authorities for a water and electric light plant, and the purpose is to erect the plant and put it in operation at the earliest possible moment.

STREET RAILWAYS.

Alton, Ill.—President Porter of the Alton Railway & Illuminating Company declares that his company intends to spend at least $50,000 in the extension of its plant here next year. The plans include the adding of fifteen new pattern electric cars and the laying of ten miles of new track, including a line to East Alton.

Baltimore, Md.—Surveyors are now engaged making an estimate of the cost of construction of the proposed line of electric railway which is to run from Baltimore through Anne Arundel county to Gibson's Island, or Mountain Bar, as it is sometimes called, on the shore of the Chesapeake bay, 14 miles from Baltimore. A certificate of the incorporation of the company has been filed at Annapolis, and the Commissioners of Anne Arundel county have adopted a resolution granting the company the use of the necessary public roads and bridges. The capital stock of the company is $50,000, and the incorporators named are Frank S. Revell, Elijah Williams, F. Eugene Wathen, George E. McDonald, Frank L. Hancock, B. R. Anderson, Robert Moss and James P. Bannon of Anne Arundel county; Walter R. Townsend of Baltimore county and James Bond and John F. Williams of Baltimore City.

Boulder, Col.—The city council has granted a franchise for an electric car line in the city to W. C. Dyer, J. W. Dean, E. C. Allen and Guy D. Duncan.

Butler, Pa.—At a public meeting held here a few nights ago, a resolution was passed to the effect that it was the sense of the meeting that a street railway is desired, and that council be recommended to grant a franchise with proper restrictions. It is likely that an effort will be made to come to terms with the company from Warren, Pa, which already has a charter.

Cleveland, O.—The Consolidated Traction Company is introducing electric heaters on its cars.

Clinton, Mass.—The Clinton, Hudson, Maynard & Concord Street Railway Company has filed with the selectmen its bond for $10,000 to fulfil the requirements of the franchise and have the road in operation within eighteen months.

Haverhill, Mass.—The strike of electric car employes here, due to the company requiring conductors, etc., to furnish indemnity bonds, is about closed as many of the men have returned to work and the cars are running on schedule time.

Kansas City, Mo.—P. D. Armour of Chicago has recently largely increased his holdings in the Metropolitan Street Railway, and N. B. Ream of the same city has purchased a large block of the stock from Robert Fleming of London and has been made a director. The earnings of the company have shown a gradual improvement in the last year and are now understood to be equal to 7 per cent. on the capital. It is believed here that Armour and Ream desire to gain control of the entire street railway system of Kansas City, and that they will make many improvements and extensions, changing the cable roads to electric.

Knoxville, Tenn.—Frank S. Hambleton of Baltimore, president of the Knoxville Traction Company, and a number of Baltimore and New York capitalists interested in the Knoxville street railway system were given a public reception at the Imperial Hotel on the evening of the 27th ult. It was one of the most imposing affairs in the history of the city and originated in the desire of the business men to entertain the men who in giving Knoxville superior street railway facilities and in other ways had done so much to build up the city. Gen. C. C. Howell, vice-president of the Knoxville Traction Company, introduced the visitors to their entertainers.

Laurel, Md.—The establishment of a public park at Brashear's Springs and an electric railway from Savage to the Springs is being promoted by Mayor Edward Phelps and some Baltimore capitalists.

New Hartford, N. Y.—The trustees have voted to grant a franchise through the village to the Sauquoit Valley Electric Street Railway Company, a condition being that the fare to Utica shall be not more than five cents.

Rochester, N. Y.—The local directors of the Sodus Bay Electric Railway Company, as the result of a conference with the highway commissioners, have secured right of way along the Ridge road to Sodus.

Rockford, Ill.—The Rock River Construction Company, which has taken the contract to build the Rock River Electric Railway, agrees to have the line completed from Rockford to Oregon, a distance of thirty miles, by January 1.

Steubenville, O.—Preliminary surveys have been completed for a new street railway line between this city and Mingo Junction, and the line will likely be built within the next few months. It is asserted that the line is to be part of the system which is to connect Pittsburg with Wheeling by way of the towns along the Ohio river.

Terre Haute, Ind.—A trolley line is being promoted to run between Terre Haute and Merom, thirty-two miles.

Washington, D. C.—The contract for equipping the City & Suburban Railway, formerly the Eckington, has been awarded to E. Saxton of this city. Mr. Saxton has done all the work of equipping the street railways in Washington that have changed their motive power to a modern system. He has also done considerable work in this line in New York City.—It is expected that the stockholders of the Columbia Street Railroad Company will hold a meeting early this month for the purpose of granting the necessary authority for the issue of bonds which will be needed to furnish the money required to construct the proposed eastern extension of the road out Benning road to the District bounds. It is also understood that at the same meeting the stockholders will be called on to approve the plan of changing the cable motive power on the present line to the underground electric system, so that the entire road will be operated by electricity. It is estimated that the entire cost of the proposed work, including the fitting up of the power house, will be about $450,000, and it is expected that bonds to that amount will be issued.

York, Pa.—It is understood here that the new management of the York Southern Railroad Company intend to change the branch line running from Delta to Peach Bottom into a trolley road, the power to be supplied by the Delta Electric Power Company.

MANUFACTURING, ETC.

Detroit, Mich.—A fire which broke out in the building occupied by the Michigan Electric Company, on the 24th ult., almost entirely destroyed the stock of the company, valued at $50,000. It was fully insured.

New York.—The "Journal of Commerce" of September 29 says: "The demand from Italy for certain manufactures is making satisfactory progress. Upwards of 21,000 worth of electrical material has been purchased this week in the local market by shippers to Genoa. Exporters interested in the trade claim that in the electrical line orders will be forthcoming to a greater extent during November and December on account of the advancement being made in many districts of the country with which home products cannot possibly cope. American manufacturers are at present actively engaged in sending estimates of some magnitude through their European agents."

TRANSMISSION PLANTS.

Porterville, Cal.—W. H. Hammond has returned from England, whither he went to obtain financial backing for a scheme to develop electrical power for irrigation and other purposes. The plant will be established twenty-nine miles east of Visalia on the Kaweah river. The estimated cost of putting in the plant and extending the system to Visalia, Tulare, Porterville and Lindsay is $250,000.

COMPANY MATTERS.

Columbus, O.—A dispatch from Fremont, O., states that "one of the biggest deals ever engineered in Fremont is about to be consummated. By the transaction Eastern capitalists will acquire possession of the Northwestern Ohio Mutual Gas Company's plant in Fremont, also the plants of the Fremont Electric Light & Power Company, the Fremont Gas Company, the Creager Light & Power Co., and the Fremont Street Railway Company. All of the above plants are to be merged into one and managed and operated under one head."

PERSONAL AND MISCELLANEA.

John Leach, an engineer at the Evansville, Ind., electric light plant, on the night of the 24th ult. fell into the running machinery and was instantly killed.

John H. Moffit, general manager of the Syracuse (N.Y.) Rapid Transit Company, has resigned. It is thought likely that his successor will be C. Loomis Allen, engineer of the road.

Samuel L. Gilmore of Lewiston, Me., a lineman on the Lewiston, Brunswick & Bath electric road was killed recently by a shock from an 18,000 voltage wire. He was at work repairing a wire about three miles from Lewiston when the accident occurred. Gilmore was about 30 years of age.

Col. Eugene Griffin of the First Regiment Volunteer Engineers and vice-president of the General Electric Company, who returned sick from Porto Rico on the transport Concho, which arrived at New York several days ago, is not yet fully recovered from the attack of fever which prostrated him.

At Albany, N. Y., a few nights ago, a lad named Jeremiah Kennally was struck dead by an electric shock

which he received while endeavoring to get a light for his cigarette from an arc light in a music garden. As soon as Kennally touched the light he fell to the ground and died almost instantly.

A special to the Denver "News" from Salt Lake, Utah, states that a test of the Whitehead electric volley gun, the invention of a Salt Lake man, was made on the 16th ult., in the presence of a number of Eastern ordnance experts and Prof. D. C. Hanish of London. The test demonstrated that the twenty-barrel gun would discharge upwards of 10,000 shots per minute. The projectiles are of a special pattern, being the invention also of Mr. Whitehead. The experts were satisfied by the test, and pronounced the invention superior to any machine gun now in use. Several of the guns will be made by a Connecticut firm at once, and a test will then be made by the War Department.

Alexander Graham Bell, the inventor of the telephone, arrived at San Francisco, Cal., two weeks ago on his way to Japan. He was accompanied by his wife and daughters and sailed for Yokohama on the steamship Coptic. In conversation with a representative of the "Call" he said: "I have not given the telephone much attention of late, for I have not been connected with any telephone companies during the last fifteen years. Aerial navigation and its multitudinous problems have absorbed my time to the exclusion of all other scientific questions. I am now preparing a series of papers on the subject of aerial locomotion for the National Academy of Science. They will be published soon after my return to this country. Aerial navigation is coming; it is almost here. I was a witness of the first practical aerial test made—that of Prof. Langley with his aerodrome propelled by steam, and we may soon expect great strides in this line of invention."

A correspondent of the Cambridge, Mass., "Tribune" has been visiting Chillicothe, Ohio, lately, and had there his first cognition of a woman street-car conductor. He boarded a car the conductor of which was "an exceedingly attractive specimen of the fair sex," and gives his impressions as follows: "At first I supposed that this was some special graft of the Young Women's Christian Association, and that 'the proceeds of the day were to be devoted to the Soldiers' Aid Association,' or some other equally laudable beat, and I looked carefully through my pocket for something smaller than a quarter before I proffered my fare, as I anticipated 'there would be no change on this special occasion.' But I was in error, for a ten-cent piece and two nickels were extracted from the leather bag the young woman wore at her waist-belt, and I received my change with a blush at my unwarranted suspicion. A series of inquiries from my neighbor in the car resulted in discovering that the Chillicothe Street Railway Company have in their service seven young women (my informant, who was a gay youth with a red necktie and a general air of levity, characterized them as 'mainly daisies') who are performing their arduous duties in a thoroughly polite, conscientious and satisfactory manner, commanding the respect of all (and the evident admiration of my youthful friend), while working nine hours daily, with one day off in seven, and receiving for their labor the altogether preposterous remuneration of $4 per week! I did not fail to observe that the young woman who personally conducted my car was neatly and suitably dressed and that she managed to keep her hands clean—a saving grace that seems absolutely unattainable to the average male street-car conductor."

COMMERCIAL PARAGRAPHS.

From all accounts the Electrical Engineer Institute of Correspondence Instruction, 120 Liberty street, New York, is prospering. There are three excellent courses of study offered by this Institute to those who desire to obtain an electrical education but who cannot well spend the time to attend a college. The junior course, in which the simple mathematics and elements of electricity are taught, costs $55, payable in monthly installments of $2. For the senior course the charge is $75, payable in like manner. A more advanced course is offered to those desiring to become proficient in the design of continuous and alternating current apparatus, for which $55 is charged, payable in $2 monthly installments. We understand the instruction papers of this Institute have been carefully compiled by some of the leading engineers in the electrical profession. A correspondence school such as this should undoubtedly prove of value to a large number of persons who are employed during the day and have only the evening in which to study.

The growing demand and the popularity of the Power Pump manufactured by Goulds Manufacturing Company of Seneca Falls, N. Y., has made it necessary for the company to greatly increase the number and variety of its patterns. In a catalogue recently issued by this well-known concern a large number of different types of Power Pumps are fully illustrated and described, as well as a number of pumps now in actual operation for special purposes. The catalogue will be sent to those interested on request. The branch offices of this company are at 16 Murray street, New York, 8 Oliver street, Boston, and 22-24 North Canal street, Chicago.

Owing to a disastrous fire on September 24 which destroyed their offices the Michigan Electric Company, Detroit, Mich., announce that they have leased temporary quarters at 106 Woodward avenue, where arrangements have been made for carrying on business as usual. A new stock of electrical material is already on hand, so that there will be no delay in the filling of orders. Work on permanent quarters is now being pushed with all possible speed, and in a very short time this well-known company will be in better condition for business in all departments than ever before.

The Carborundum Company of Niagara Falls, N. Y., have now ready for distribution an exceedingly attractive catalogue descriptive of their goods. In this book, which contains over sixty pages, is described and illustrated the various productions of this concern as well as a large variety of goods manufactured out of carborundum. These include cloth, paper, rubbing bricks, scythe stones, and drum wheels for use in the making of gloves. The New York representative of the Carborundum Company is Mr. Emil Ulrich, 136 Liberty street.

We are in receipt of an interesting and attractive booklet recently gotten out by the Graham Equipment Company, 170 Summer street, Boston, describing the well-known Graham Steel "I" beam truck. The main stress member of the side frame of this truck is a Carnegie steel I beam, weighing 10 lbs to the foot. This beam runs the entire length of the truck, and forms a continuous support for the car body, which is rigidly bolted to it. No spring base is used, the flexible suspension being confined entirely to the axle-boxes. The use of the I beam frame permits securing the pedestals and motor supports by single bolts and makes the side frame very rigid and stiff, without the use of either bolted or riveted joint.

It is the simple and logical application to truck building of the most approved transverse stress member in bridge and roof construction.

The center cross member is a 5" steel channel, held fast by two ¾" rods, the end cross members being 3" extra heavy steel tubing, with ¾" rods through the center. The rods bind the two side frames together, making the strongest, lightest and simplest truck frame ever built.

These trucks are now being sold at $150 each, and how highly they are thought of may be gathered from the following letter:

Winchester Ave. R. R.,
West Haven, July 18, 1894.

The truck gives perfect satisfaction. I consider it the best truck on the market, and the president and board of directors say it is the finest riding truck they ever rode on.
Yours truly, ALBERT E. POND, Supt.

The Electric Appliance Company, Chicago, have taken the general Western agency of the Utility Shade Company, manufacturers of the Utility Shades in paper and celluloid. These shades are something quite new in the electrical line and are destined to find a very large field as they possess a great many points of merit, among which may be mentioned the following: They are very light in weight, neat in appearance and practically indestructible. They require no separate shade holder and are low in price. They are made in a number of different shades and colors. The Electric Appliance Company have issued a special catalogue of these goods, which they will be pleased to send to the trade upon application.

The Warren Electric & Specialty Company of Warren, Ohio, well-known manufacturers of High-Grade, Anti-Trust Incandescent Lamps, have recently gotten out an attractive blotter in which they say:

POINTERS WITH A POINT.

No. 1. Who furnished four thousand two hundred and twenty volt lamps for the new steel pier at Atlantic City? We did. Were they satisfactory? Write the management there and see.

No. 2. Woman leads the world. She used smokeless powder for ages before men thought of inventing it.

No. 3. Who sold ten thousand lamps to the Masonic Temple in Chicago? We did.

No. 4 Science has discovered microbes in kisses. This shows the microbe is not such a fool as he looks.

No. 5. If we can please such large and critical buyers as the above, don't you believe we can please you? We will try hard. Try us please. We have a strictly high-grade lamp at a close price.

No. 6. Better save your burned-out lamps and bases and when you have 250 write us. They are worth money.

The Schieren Booth at the Omaha Exposition.

One of the most attractive booths in the Machinery and Electricity Building at the Trans-Mississippi Exposition is that of Chas. A. Schieren & Co., in the busy northwest corner of the building.

The most prominent feature of the exhibit is a monster perforated electric belt 72 inches wide. This is one of a great number of belts of that size manufactured by Chas. A. Schieren & Co., and is a striking example of the art of making large belts, in the manufacture of which this firm excels.

At one side of the booth an immense hide is suspended, intended simply to exemplify their justly celebrated Dixie tannage. Alongside is a picture of their famous Dixie tannery, Bristol, Tenn. The capacity of this tannery is 60,000 heavy hides per year. It is located in the heart of one of the best oak bark regions of the country. The tannage is the old long process with pure oak bark. This, together with their high order of workmanship, is conclusive of the fact that they secure to their belts the longest possible life and wear in leather belting. There are several rolls of their high-grade short-lap belting on exhibition.

The electric and perforated electric belting is well represented. This, the perfection in belting for dynamos and other swift-running machinery, is too well known to need any description here. It is to be found in use in every city and almost every town in this country and also very extensively in Europe, South America, Asia, and in fact all over the world.

There is also a roll of link belting, showing the patent American joint, which enables the belt to conform perfectly with the crown of the pulleys and to run perfectly on odd drives, as for instance a "quarter turn" Another of this firm's many contributions in the line of progress to be seen at the Exposition is their "Giant" lace leather. This is unique in color but is gotten out solely for strength and durability, and the demand for it is conclusive proof of its great and uniform success.

It is a significant fact that on oak backs, bellies and shoulders, which are also represented in their exhibit, Messrs. Chas. A. Schieren & Co. justly enjoy the same reputation among shoe manufacturers as upon leather belting and lace leather in the immense community of belt users.

The exhibit includes also Pump and Valve leather, Round Solid, Twist and Patent Solid belting, Electric Belt Dressing and Cement.

A visit to this attractive booth (see illustration) is bound to prove instructive to all users of leather, and the interesting literature dispensed as souvenirs will commend itself to all seeking information in this line. Mr. Herman A. Giese is the representative in charge.

We are in receipt of two handsomely gotten up catalogues recently issued by the New Britain Machine Company of New Britain, Conn. One of these describes in detail the Case Automatic High-Speed Engine and contains some forty pages. It is fully illustrated with half-tone cuts and there are several useful tables showing the horse-power, speed, floor or other space required, etc. The sec

ond catalogue is devoted to a description of the Chain Saw Mortiser manufactured by the same concern. The various types of mortisers are shown with a description of each. In each case the specification is given as well as a short table showing exactly what that special type of chain saw mortiser will accomplish. The last few pages are devoted to a number of very favorable testimonials. In short, these two catalogues describe in an attractive manner the high grade goods for which this company has been enjoying a large domestic and foreign demand.

RECENT COMPANY ELECTIONS.

Philadelphia Traction Company, Philadelphia.—President, George D. Widener; vice-president, William L. Elkins; secretary and treasurer, Alexander Rennick; directors: P. A. B. Widener, William L. Elkins, Thomas Dolan, James McManes, J. B. Altemus, George W. Elkins.

Union Traction Company, Philadelphia.—President and general manager, John B. Parsons; vice-president, George D. Widener; secretary and treasurer, Charles O. Kruger; directors: John B. Parsons, George D. Widener, Peter A. B. Widener, William L. Elkins, Thomas Dolan, James McManes, Alexander M. Fox, Jeremiah J. Sullivan, Alfred Smith, William H. Shelmerdine and George W. Elkins, the last named being elected to fill the vacancy caused by the retirement of John Lowber Welsh.

INCORPORATIONS.

The Eureka Electric Company, Chicago, Ill. Capital stock, $10,000. Incorporators: J. Kusel, Arnold Cohn and H. J. Kusel.

The McKinney Electric Light & Motor Power Company has been incorporated at Austin, Texas, its purpose being to supply electricity to the public for all purposes. Capital stock, $17,000. Incorporators: L. A. Scott, J. P. Nunciey and D. T. Pardue.

The Georgia Heating & Lighting Company, Atlanta, Ga. Capital stock, $10,000. President, J. F. Burk; secretary and treasurer, Dr. R. J. Thurmond; directors: J. F. Burk, R. J. Thurmond, R. H. Wilhoyte, W. A. Ellis and W. T. Glacon.

The Missouri Electrical Railway Company, Kansas City, Mo.—to build and operate street railways in Kansas City, Jackson and adjoining counties, the motive power to be electricity, compressed air or cable, and to deal in street railways and street railway securities. Capital stock, $500,000, divided into 100,000 shares of $5 each. Stockholders and directors: Chett McDonald, Henry Smith, Benjamin F. Burd, William H. Brown and Frank W. Sears, all of Kansas City. Mr. Sears holds 99,200 shares.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED SEPTEMBER 27, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

611,271. Electric Railway. Oscar Preil, Washington, D. C., assignor to the Wheless Induction Railway Company, same place. Filed Dec. 30, 1897.

611,367. Trolley-Pole. Albert M. Meredith, Philadelphia, Pa., assignor, by direct and mesne assignments, to George Grant Armor, Baltimore, Md. Filed March 31, 1897. Renewed July 16, 1898.

611,481. Motor-Mounting for Electric Cars. Sidney H. Short, Cleveland, O. Filed June 26, 1897. Renewed May 19, 1898.

611,559. Electric-Railway System. George L. Campbell, Dushore, Pa. Filed Oct. 29, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

611,460. Electric-Arc Lamp Timothy H. Pettengill, Amsterdam, N. Y. Filed Sept. 4, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

611,273. Means for Supporting Electric Motors. Louis T. Pyott, Philadelphia, Pa. Filed May 14, 1897. Renewed Feb. 23, 1898.

611,465. Controller for Electric Motors. Harry P. Davis, Pittsburg, Pa., assignor to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed April 19, 1898.

611,501. Mechanism for Imparting Successive or Alternating Movements. Elisha Moore, Meductic, Canada. Filed Feb. 3, 1898.

611,558. Apparatus for Starting Motors. James Burke, New York City, assignor to the Bullock Electric Manufacturing Company of Ohio. Filed April 4, 1898.

TELEPHONE AND TELEGRAPH APPARATUS.

611,448. Apparatus for Printing Telegraphic Messages. Godfrey M. Gibson, Chumleigh, England. Filed Nov. 10, 1896.

611,581. Telephone System. Georg Ritter, Stuttgart, Germany. Filed Feb. 23, 1895.

MISCELLANEOUS.

611,243. Safety-Fuse for Electric Circuits George W. Gardanier, Nyack, N. Y., assignor of three-fourths to David G. Black, Lake Hill, N. Y., and Thomas J. Smith, Roselle, N. J. Filed Dec. 16, 1897.

611,258. Truss-Frame for Electric Vehicles. Karsten Knudsen, Chicago, Ill., assignor to the American Electric Vehicle Company, same place. Filed Oct. 20, 1897.

611,466. Alternating Current Measuring Instrument. Harry P. Davis, Pittsburg, and Frank Conrad, Wilkinsburg, Pa., assignors to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Filed May 7, 1898.

611,592. Alternating-Current Voltmeter. Harry P. Davis, Pittsburg, and Frank Conrad, Wilkinsburg, Pa., assignors to the Westinghouse Electric & Manufacturing Company of Pennsylvania. Original application filed May 7, 1898. Divided and this application filed June 18, 1898.

DESIGN.

29,410. Transformer-Case. Frederick C. Sutter, Swissvale, Pa. Filed Aug. 6, 1898.

TELEPHONE AND TELEGRAPH.

The Telephone Deal in Minnesota.

The St. Paul *Pioneer-Press* of the 21st ult. gives some further particulars relative to the telephone deal in Minnesota. It says: "The Northwestern Telephone Exchange Company yesterday closed a deal by which it acquires control of the independent long distance lines in Southern and Western Minnesota, Northern Iowa and South Dakota, including the Minnesota Central Company, which recently secured a franchise in St. Paul. The lines included are the Western Electric system, the Western Electric Telephone Company, the Minnesota Mutual Telephone Company and all their dependent and allied companies, which include the Southern Minnesota and Southern Dakota Telephone companies, the Union Electric Telephone Company, the Minnesota Central Company, and Western Minnesota Telephone Company. The parties to the agreement agree that their long distance lines shall hereafter operate in harmony and in direct connection. They will be interconnected so that any town in the territory of any company which is a party to the agreement can get direct telephone connection with any other town on any of the wires of the allied companies. The new deal goes into effect to-day. All the parties to the agreement are bound not to have any business relations with other companies, thus preventing outsiders from making any sort of connection with them."

Referring to this coup of the telephone monopoly the Boston *News Bureau* says:

"We understand that the purchase price of the 900 miles of independent telephone line in the Northwest by the Erie Telephone Company was $50,000. [The Northwestern Company is controlled by the Erie.]

"Boston people do not realize the importance of the above purchase to the Erie Telephone Company. The independent telephone movement in the Northwest had assumed large proportions. There were five companies in the field with a capitalization of $30,000, all under the management of the Western Electric Telephone Company. These companies owned 3,000 miles of toll line in the Northwest, practically embracing the entire toll line opposition in the States of Minnesota, Iowa and the Dakotas, and reached 300 points not reached by the Erie Company.

"The Erie Company purchase was of the lines of the Union Electric Telephone Company, which is the only independent company paralleling the Erie Company's lines, but as a result of this purchase the Erie Company agrees to place Bell instruments on all the Western Electric Company's lines at a small rental which includes the cost of repairs, and both systems will be operated as one.

"This is declared to be the first instance where a Bell company has ever entered into an extensive arrangement with an independent company; the previous policy has been to ignore or fight the independents. In this case there is no transfer of stock, other than of the Union Company, and the independent companies maintain their separate existence and build and maintain their own lines.

"This purchase is considered of great advantage to the Erie Company as it practically cuts off the new Minneapolis independent telephone exchange from all toll connections, for undoubtedly in connection with the Western Electric Company's lines the Minneapolis company would have been able to make inroads on the Erie Company's business. This agreement likewise cuts off a number of other independent exchanges in various cities, as under the agreement only toll lines are embraced, and it prohibits any affiliation with lines other than those using Bell instruments."

The Poughkeepsie *Eagle* states that a large force of men is at work at Fishkill Landing putting up poles and wires for a long distance telephone to connect Fishkill, Newburg and Peekskill directly with New York City. This work is being done by the American Telegraph & Telephone Company for the Hudson River Telephone Company. The new cable across the river at Newburg is for this line. Heretofore the crossing of the river has been made by the cable at New Hamburg.

The construction of the new Standard telephone exchange at Atlanta, Ga., is nearing completion. The underground conduits will be finished in about three weeks. The officials of the company state that 1,000 'phones would be in operation by January 1 and over 3,000 in a few weeks after that. The Standard company is offering 'phones at much lower rates than the Bell, but it is expected that the Bell company will meet these rates, and perhaps cut under them when the Standard people begin operations.

The Michigan Bell Telephone Company has won its suit against the city of St. Joseph, Mich. The decision gives the company the right to erect poles in certain streets which the council refused.

A special to the St. Paul *Dispatch* from Park Rapids, Minn., states that Moody & Kerlin will soon begin the construction of a telephone line from Park Rapids, via Hubbard and Latona, to Mehnaga.

Association of Fire and Police Telegraph Superintendents and Municipal Electricians.

Chairman Ellett of the Executive Committee of the Association of Fire and Police Telegraph Superintendents and Municipal Electricians has issued a call for a meeting of his committee for October 8 and 9, at Wilmington, Del., the home of the President of the Association, Mr. John W. Aydon. The following gentlemen compose the committee:

W. Y. Ellett, Supt. Fire Telegraph, Elmira, N. Y., Chairman.

M. W. Mead, City Electrician, Pittsburg, Pa.

Capt. William Brophy, Chief Electrician Wire Inspection Department, Boston, Mass.

W. H. Thompson, City Electrician, Richmond, Va.

F. C. Mason, Supt. Police Telegraph, Brooklyn, N. Y.

The committee at this meeting will revise the By-laws of the Association and decide upon matters pertaining to the next regular meeting of the Association, which will be held at Wilmington, Del., September 5, 1899. All members of the Association are invited to be present at this meeting of the Executive Committee on October 8 and 9, President Aydon having arranged to entertain all who can make it convenient to do so.

Applications for membership will also be received and acted upon at this session.

A practical test of the Canadian Pacific's new copper wire was made on Wednesday last between Montreal and Vancouver, and the time consumed in sending a message to Montreal and transmitting reply to Vancouver was about a minute. The wire was duplexed, being made capable of carrying two messages in the opposite directions. The actual distance covered by this new wire is about 2,900 miles, constituting probably the longest direct land line circuit for daily work in the world. To pass across this immense distance signals only occupy one-fifth of a second. This direct current will enable Montreal, Vancouver, Winnipeg, Rossland, Nelson and other far Western points to transact speculative business between these points almost as quickly as between Montreal and Chicago. The alternative telegraph line to the Kootenay via the Crow's Nest Pass line, will also be completed this fall.

At Chattanooga, Tenn., an ordinance introduced in the council to extend the franchise granted to J. A. Helvin for a new telephone system, which expired September 7, was referred to a special committee consisting of Aldermen McMahon, Martin, Glover, Forstner and Hill.

The long distance telephone line between Portland, Ore., and San Francisco is nearly completed. There is a gap of forty miles only between Grant's Pass and Oakland, Ore., remaining to be wired, and 100 men are now at work on this section.

Consul Roosevelt at Brussels writes that work is soon to be begun on a telephone line between Berlin, Brussels and Paris. When completed, the line will be more than 620 miles long, and therefore the most important telephone line in Europe.

New Companies Incorporated.

At Jefferson City, Mo., the Atlanta Telephone Company of Atlanta, Macon county, Mo. Capital stock, $2,700. Incorporators: H. H. Abbott, S. H. Nash, R. B. Turner and others.

At Trenton, N. J., the Atlantic Telephone Company. Capital stock authorized, $100,000. Incorporators: Frederick L. Benson, Alfred Dingler, Jersey City; John J. McCloskey, Philadelphia.

The Postal Telegraph Cable Company, Des Moines, Ia.—to construct, acquire and operate telegraph lines within the State of Iowa. Capital stock, $50,000. Incorporators: C. F. Fox, R. J. Wurst and R. W. Banks.

The Ottumwa Long Distance Telephone Company, Ottumwa, Ia.—to build long distance telephone lines in the States of Iowa and Missouri. Capital stock, $10,000. Incorporators: J. C. Goddard, A. H. Cowdery and P. E. Wilcox.

The Morgantown & Dellslow Telephone Company, Morgantown, W. Va. Capital stock, $100,000; subscribed, $500; paid in, $50.

The Luraville & Suwanee River Telephone Company, Luraville, Fla.—to construct and operate a telephone system. Capital stock, $3,000. Incorporators: Thomas I. McIntosh of Luraville, Sidney V. Hough of Lancaster, Fla., L. T. Boatright of Live Oak, Fla., William T. Dees of Mayo, Fla.

The Meridian Telephone Company, Meridian, Miss. Capital stock, $16,000. Incorporators: J. D. P. Lewis, J. P. Walker, Henry A. Coit, Henry A. Turner and others.

The Greenbrier & Pocahontas Telephone Company, Ronceverte, W. Va. Capital stock, $1,500.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N Y.—Oct 3:						
Albany Ry. Co	100	2,000,000	$1,750,000	1¼ % Q., Aug. '98.	153	155
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug, 98.	53	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Oct 3:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Oct 3:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	89	..
Baltimore, Md.—Oct 3:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98.	71	72
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	3 % S., July 15, '98	22⅞	23
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	80	82½
Boston, Mass.—Oct 3:						
New England Street Ry	25	5,000,000	1,061,925	1 % Q., Jan.15, '97.	...	..
North Shore Traction Co......com.	100	4,000,000	4,000,000	....	10½	11
North Shore Traction Co......pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	78½	79
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	83¾	84
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	105	106
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	69	69½
Brooklyn N. Y.—Oct 3:						
Brooklyn City & Newtown Ry	100	2,000,000	1,928,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	64⅜	64½
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR......guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	215	215½
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	236	240
Kings County Elevated	....	4,750,000	4,750,000	....	6	7
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	....	6,000,000	6,000,000	....	..	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Oct 3:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	67	68
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	79	81
Columbus O.—Oct 3:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Aug., '98.	51½	53½
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Oct 3:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '98.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Oct 3:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q.	290	292
Chicago & South Side R. T. RR	100	10,823,800	10,823,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	13	13¾
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., July, 98.	219	222
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,608,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Aug. 98.	93½	94
jChicago West Div. Ry......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry......guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Oct 3:						
Cincinnati Inc. Plane Ry......com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry......pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	117⅛	118
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1½ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Oct 3:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	..	..
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	70	74
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98.	77	81
Detroit, Mich.—Oct 3:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	....	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Oct 3:						
City Railway Co......com.	100	1,500,000	1,470,600	1¼ % Q., Jan.1,'98.	104	105
City Railway Co......pfd.	100	600,000	600,000	1½ % Q., Jan. 1,'98	155	156
People's Street Railway	....	1,100,000	....		102	103

*Unlisted. †Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $525,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Oct 3:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	3 % S., Jan., '98.	140	--
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	--
Holyoke Mass.—Oct 3:						
Holyoke Street Ry. Co	100	400,000	400,000	3 % A., Jan., '98.	180	190
Hoboken, N. J.—Oct 3:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	3 %, 1892.	70	--
Indianapolis, Ind—Oct 3:						
**Citizens' Passenger Ry	....	5,000,000	5,000,000	....	25	26
Lancaster, Pa.—Oct 3:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	--
Lancaster & Col. Electric Ry	....	....	37,500	....	..	--
West End Street Railway	...	....	....	....	..	--
Louisville, Ky.—Oct 3:						
Louisville Ry......com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	34	39
Louisville Ry......pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	96	100
Minneapolis, Minn.—Oct 3:						
Twin City Rapid Transit......com.	100	17,000,000	15,010,000	....	25	..
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,714,200	1¾ %. Jan., '98.	101	102
Montreal, Canada.—Oct 3:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	275½	276½
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	102⅞	108
Memphis, Tenn.—Oct 3:						
Memphis Street Railway Co	100	500,000	500,000	....	15	--
New Haven, Conn.—Oct 3:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '98.	60	80
New Haven & Centerville	100	700,000	800,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—Oct 3:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	150	180
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	124
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	2½	3
New Orleans Traction Co......pfd.	100	2,500,000	2,500,000	....	8½	10
aCrescent City RR......guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	..	28½
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23	26
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	52½	55
New York—Oct 3:						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98.	170	190
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98.	156	157
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	33½	37
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	218	220
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	177	185
hEighth Avenue RR	100	1,000,000	1,000,000	....	350	365
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	..	...
jNinth Avenue RR......guar.	100	800,000	800,000	....	175	180
kSixth Avenue RR......guar	100	2,000,000	2,000,000	....	220	225
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	310	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q.. July, '98.	180	182
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. 98.	168	172
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	65	..
*Union (Huckleberry) Ry	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Oct 3:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	50½	51½
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	‖1¾ % A.	195	205
Pittsburg, Pa.—Oct 3:						
Allegheny Traction Co	50	500,000	500,000	....	..	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	20	2⅛
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	56	56½
pCentral Traction Co	50	1,500,000	‖900,000	....	...	...
qCitizens' Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	..
rDuquesne Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	25
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	‖2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	2⅜	2¾
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	300,000	200,000	....	..	..

*Unlisted. ‡Full paid. ‖Outstanding. †Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds..

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value o stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford, Mass—Oct. 3						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass—Oct 3						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Oct 3:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Oct. 3:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Oct 3.						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	70	72
Philadelphia.—Oct 3:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	583,900	‡533,900	3 % S—July, '98.	67	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	65½	66
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450	....	19⅞	19½
cElectric Traction Co	50	....	8,297,920	....	7 ⅝	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	3.7	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	394	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	268	...
ePeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '93.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135	136
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
ePhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh., Oct. 98.	90⅛	90½
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	175	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	88	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	285	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	270	275
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.—Oct 3:						
Rochester Railway Co	100	5,000,000	5,000,000	....	15	20
Reading, Pa.—Oct 3:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	15	20
kCity Passenger Ry	50	350,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Oct 3:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct., '98.	180	182
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR.	100	2,000,000	1,500,000	4 %, Oct., '93.	90	110
St. Louis RR.	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR.	50	2,400,000	2,300,000	1½ % Oct., '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry.........com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	114	116
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	50	51
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Sept.						
California St. Cable RR.	100	1,000,000	600,000	50c. monthly.	106	107¾
Geary Street Park & Ocean RR.	100	1,000,000	875,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53⅞	54¼
Presidio & Ferries RR.	100	1,000,000	550,000	....	8⅛	8⅝
Scranton, Pa—Oct 3:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Oct 3:						
Springfield Consolidated Ry	100	750,000	750,000	....	—	11
Springfield O.—Oct 3:						
Springfield Street Ry	100	1,000,000	1,000,000		..	2
Springfield, Mass.—Oct 3:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	194	200
Toronto Canada.—Oct 3:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	102⅞	103
Montreal Street Railway Co	...	4,000,000	4,000,000	4 % S.	275⅞	276½
Washington, D. C.—Oct 3:						
Belt Ry. Co	50	500,000	500,000	....		
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	74½	75
Columbia Ry. Co	50	400,000	400,000	6 % A.	75	..
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	8	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	..	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	121½	125½
Worcester, Mass.—Oct 3:						
*Worcester Traction Co........com.	100	8,000,000	8,000,000	....	14½	18½
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	95	98
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Oct 3:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%. Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
g Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Oct 3						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., July, '98.	280	..
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '98.	74¼	..
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	139	..
New York.—Oct 3:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	96	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	109	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	170	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	74½	..
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	118
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	109	112
Mexican Telephone Co	100	2,000,000	......		..	63
*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1½ % Q., July, '98	150	152
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	92	..
†Commercial Union Telegraph Co.	25	500,000	500,000	8 % S., July, '93.	110	118
Western Union Telegraph Co	..	......	97,870,000	1¼ %, Oct., '98.	9.3⅛	92
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Oct 3:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	171½	..
Chesapeake & Potomac Telep. Co.	100	......	......	....	50	...
Chicago Telephone Co	100	......	......	......	212	..
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	132½	134
Empire & Bay States Telegraph Co.	...	......	......	....	68	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	70	77
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	112	115
Providence (R. I.) Teleph. Co	50	....	......	....	86	90
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	122

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Oct 3:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25				..	..
†General Electric Co. [old] ... com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new] ...... "	100	18,276,000	18,276,000	......	80	80½
T.-H. Elec. Co..T. Secur., Series D.					2½	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700		33½	..
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	57½	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Oct 3:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,938,000	....	130	134
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '98.	121	123
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..				21	23
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug, 1898.	..	..
General Electric Co. [new].... "	100	18,276,000	18,276,000	......	80	80½
Interior Conduit & Insulation Co	100	1,000,000	1,000,000		41	..
Pittsburg, Pa.—Oct 3:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	160	
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Oct 3:						
Edison Electric Light Co	100	2,000,000	.....	......	144½	
*Electric Storage Battery Co...com.	100	8,500,000	.....	......	88½	89¼
*Electric Storage Battery Co...pfd.	100	5,000,000	.....	......	44¼	45
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	.....	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co....pfd.	50	5,000,000	.....	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$82500 dis. Jan.11'97	13¾	14
Southern Elec. Light & Power Co.	10	187,500	187,500	....	16	
Miscellaneous.—Oct 3:						
Brush Electric Co	50					
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	.....	....	35	40
Missouri-Edison (St. Louis)....com.	..	......	.....	....	11	15
Eddy Electric Mfg. Co	25	......	.....	....	—	15
Hartford (Conn.) Elec. Light Co	100	350,000	.....	....	125	
Hartford (Conn.) Lt. & Power Co.	25	175,000	.....	....	4½	
New Haven (Conn.) Elec. Lt. Co	100	100,000	.....	....	175	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	.....	2 % Q., Oct., '98.	84	87
Rhode Island Elec. Protec. Co	100	......	.....	....	118	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q		
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	‡ 13 ⅞	135¾
Thomson-Houston Welding Co	100	......	.....	1½ % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	....	.....	....	100	110

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200. of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Oct 3:						
American Electric Heating Co	50	10,000,000				
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	85	87
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	..	..
New York.—Oct 3:						
Consolidated Electric Storage Co	..	......	....	....	18	20
Edison European	..	......	....	....	1	3
Safety Car Heating & Lighting Co	100	......	....	....	101	..
Worthington Pump Co.........com.	100	5,500,000	5,500,000	....	89	85
Worthington Pump Co.........pfd	100	2,000,000	2,000,000	7 %	97	100
Philadelphia, Pa.—Oct 3:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1	1½
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co....com.	100	8,500,000	......	....	..	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	..	70
Welsbach Light Co	5	525,100	......	....	48	49
Welsbach Light Co., Canada	5	500,000	......	....	..	2¼
Pittsburg, Pa.—Oct 3:						
Carborundum Mfg. Co	100	200,000	200,000		..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	116	120
Miscellaneous.—Oct 3:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	15	..
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	..	55
Billings & Spencer Co	25	......	......	....	30	37
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '93.	30	35½
Johns-Pratt Co	100	......	......	....	98	100
*Pratt & Whitney Co.........com.	100	......	......	....	4	8
*Pratt & Whitney Co..........pfd	100	......	......	....	45	50
Stillwell-Bierce Co	..	......	......	....	70	80
Stillwell-Bierce Co..........pfd.	..	......	......	....	96	98
Shultz Belting Co	100	100,000	......	2 % Sept. 1, '97.	60	62
St. Charles Car Co	—	......	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation— Oct 3, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..............1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*118½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..................1st 5s	....	....	......	......	*105½	106

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation– Oct 3, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	......
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	......
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	105¼	105¾
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	102½	104
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	117	118
City & Suburban Ry......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	115	115½
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	114¾	121
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	119½

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation– Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	104½	105
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	106
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation— Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	....	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¼	102⅝
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T...........4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	104¼	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	53¾	54
North Chicago St. RR........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	106½	107
West Chicago St. RR........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	100¾
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	95½
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation— Oct 3, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	103¾	104
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108
So. Cov. & Cin. St. Ry........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‖So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	103¾	104
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	103	106
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	104	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	103	104¾
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	....
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	106	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 6	100,000	94,000	1909	M. & S.	102	......

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation— Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR.............1st mtg. 6s.	....	50,000	1899	M. & N.	101	.....
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	76½	79
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	107	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	103⅛	104¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	105	110
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	......	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation— Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	109	......
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	121	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	106	110
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	106	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	......	......
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109½	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	99	100
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	105½	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	103	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	112	113
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115¾	116½
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100	......
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115½	117½
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	98	100
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	120½	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	113¾	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	109	110
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	105	108
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co..........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124	125
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	112½

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.....................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry...........1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Oct 3, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry...........1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry...................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry..................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry..................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	102	103
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry..............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	92	95
Central Traction Co...............1st mtg. 5s.	375,000	375,000	1930	J. &. J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	110	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	106½	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	106¼	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co....................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation— Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107

St. Louis.

Date of Quotation— Oct 3, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry.......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,500,000	1,000,000	1918	J. & J.	111½	112½

*With interest. *Unlisted. *With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Oct 8, 1898						
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	108
Lindell Ry. Co......................1st mtg. 5s	1,500,000	1,500.000	1911	F. & A.	107	109
Missouri RR. Co........................	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co..............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	108
People's RR. Co....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co...............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry...............Income 5s.	800,000	800,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	111	112
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	114½	115½
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Sept, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	113½	115
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	115½	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	93	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	126½	....
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127¼	128
†Park & Cliff House RR........1st mtg. 6s.	850,000	850,000	1912	J. & J.	104½	105½
†Park & Ocean RR..................1st mtg. 6s.	250,000	250 000	1914	J. & J.	107	......
†Powell St. Ry........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118	120
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Oct 3, 1898.						
Belt Ry. Co.......................Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	....
Columbia Ry............................" mtg. 6s.	500,000	500,000	1914	A. & O.	120	125
Eckington & Soldiers' Home. mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	121¾	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Oct 3, 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	112	114
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	110½	111½
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	100	101½
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	108¾	109
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	100	102
Denver City Cable Ry.........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	86
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	115	115¾
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	91½	95
††No. Hudson Co. Ry. (N.J.). Cons. mtg. 5s	3,000,000	2,378,000	1928	J. & J.	103	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	95	100
St. Paul City Ry.....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Oct 3, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	106¾	....
Pittsburg, Pa.						
Date of Quotation—Oct 3, 1898						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Oct 3, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	109⅜	110½
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	116¼	......
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Oct 3, 1898.						
American Bell Telephone.......................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co.................7s.	....	......	......	......	....	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Oct 8, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co.....................	....	....	......	......	......	25
Barney & Smith Car Co.......................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co.......................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co............................	[illegible]	......	......	......	....	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12@12⅛c.; Lake, 12¼@12⅜c.; casting, 11⅞@12c.

The new underground trolley cars on the Sixth Avenue line, New York, began running on the 1st inst.

Application has been made to the New York Stock Exchange to list $2,000,000 additional capital stock of the Third Avenue Railway.

The regular quarterly dividend of 1¼ per cent. was declared payable October 1 by the directors of the Cincinnati Street Railway Company.

The North Chicago Street Railway Company has declared a dividend of 3 per cent., payable October 15. Books close October 5 and reopen October 15.

The Central & South American Telegraph Company has declared a regular quarterly dividend of 1½ per cent., payable October 8. Books reopen October 10.

The New York & New Jersey Telephone Company has declared a regular quarterly dividend of 1½ per cent., payable October 15 to stockholders of record October 5.

The Metropolitan Street Railway Company, New York, has given notice that it will pay its debenture certificates on or before October 15 at the office of the company, 621 Broadway.

It is stated, says the Philadelphia "Times," that the Pennsylvania Manufacturing, Light & Power Company now controls every local lighting corporation in Philadelphia except the Southern Company.

The president and promoter of the new Porto Rico Cable Company arrived in New York on Thursday last from San Juan and is staying at the Imperial Hotel. He will establish headquarters in the neighborhood of the hotel.

Two-thirds of the stockholders of the Rapid Transit Railroad Company of Syracuse, N. Y., have consented to placing a secondary mortgage of $500,000 on the company's property, the money to be expended in improving the lines.

The Electrical Exchange, which since November, 1896, has been engaged in the sale of electrical apparatus and supplies at 174 South Clinton street, Chicago, made an assignment on the 22d ult. to L. O. Gilman, Chicago. The assets and liabilities of the company are estimated at $12,000 each.

A majority of the stockholders of the electric light company at Wilkes-Barre, Pa., on the 30th ult. voted to sell out their holdings to men who control the Consolidated Gas Company. A State law prohibits consolidation, but it is said the companies will work in harmony.

The governing committee of the New York Stock Exchange on the 28th ult. listed the Westinghouse Electric & Manufacturing Company's additional issue of assenting stock, $575,000, making the total amount listed $8,813,000. This stock is issued in part payment for the securities of the Walker Company.

Application has been made to the governors of the New York Stock Exchange to list the following Brooklyn securities: Brooklyn Rapid Transit $227,000 additional mortgage 5 per cent. gold bonds; Brooklyn Heights Railroad $2,225,000 consolidated mortgage 5 per cent. guaranteed gold bonds of the Brooklyn, Queens County & Suburban Railroad.

The N. Y. "News Bureau" says that while the officials of the Brooklyn Rapid Transit Company refuse to give any details concerning the deal with the Nassau Company, they admit that the control of the latter has been obtained, and that all the details will be arranged within two or three weeks. An official estimates that the operation of the two systems under one management will result in a saving of $1,000,000 per year.

The Diamond Electric Company, which has a factory at Peoria, Ill., and offices in the Fisher Building, Chicago, has made an assignment for the benefit of its creditors to David H. Robbin, Chicago. The assignment was precipitated, it is said, by the entering in the United States Court on the 27th ult. of a judgment of $10,760 against the Diamond Electric Company in favor of the John A. Roebling's Sons Company.

A mortgage for $1,000,000 was recorded in the office of the County Register at Newark, N. J., on the 23d ult. It was given by the State Telephone Company of Jersey City to the Fidelity Trust Company of Newark. The mortgage is signed by W. I. Taylor, president, and W. C. Cox, secretary of the State Telephone Company, and by Jerome Taylor, second vice-president, and Uzal McCarter, secretary of the Fidelity Trust Company.

The Edison Electric Illuminating Company of Brooklyn has declared an extra dividend of the entire amount standing to the credit of profit and loss on June 30, 1898, together with the insurance reserve, and deducting therefrom expenses incurred through the proposed issue of $10,000,000 first consolidated bonds and its purchase of the stock of the Municipal Company. Holders of the stock of September 30, 1898, and the new stock of the company will participate in this dividend, which will be paid as soon as the accounts of the company are made up. In July, when this dividend was first publicly mentioned, it was said that it would amount to about 3 per cent. on the outstanding stock.

A syndicate of Southern Pacific Railroad capitalists of which H. E. Huntington is at the head has obtained control by purchase of the Los Angeles Railway Company's property, which includes practically all the street railways in Los Angeles. The details of the transaction involve the issue of $5,000,000 in bonds by the new corporation. Of this amount $4,000,000 is to be devoted to cancelling the $3,000,000 bond issue of the old corporation, to the discharge of a floating indebtedness of $400,000 and to certain improvements to be made in the property. The bonds of the new company are to bear 5 per cent. interest. The price paid for the property of the old company is said to have been $3,900,000.

The trust deed of the Chicago & Milwaukee Electric Railway has been filed and it provides for a total issue of $1,000,000 5 per cent. gold bonds, maturing in twenty years. The Illinois Trust & Savings Bank is the trustee. Of the authorized issue, $400,000 are to be certified and delivered at once, while the remaining $600,000 can be issued only to cover 75 % of the cost of future extensions and improvements. The line has been in operation from Waukegan to Highland Park, a distance of about 18 miles, since July 1, and it is on account of this portion of the system, including private right of way, power house and equipment, that the $400,000 bonds are issued. It is stated that over $500,000 has been expended on the road as it stands.

A report has been prevalent during the week that ex-Governor R. P. Flower is seeking to gain control of the electrical interests along the Hudson River from New York to Albany with the idea of making a complete trolley line between Albany and the metropolis. Should such a project be consummated there will be trolley connection through as far as Troy and Stillwater, as electric lines already extend between Albany, Troy and Stillwater. The project involves millions of dollars. At Yonkers the street railway interests are in the hands of A. L. Johnson, president of the Nassau system, recently taken up by the Flower interests, and at Poughkeepsie the interests are controlled by J. W. Hinkley, a financial associate of Mr. Flower. The control of the Hudson City Electric Railway, the Hudson City light and power plant and the Kinderhook & Hudson Railway has been secured, and it is proposed to extend the Kinderhook & Hudson line from Niverville to Nassau, a distance of twelve miles. In connection with this project it is reported that the plan is to absorb all of the chief electric lighting companies, with a view to furnishing power and light from the same plants, and thereby cheapen the cost of production.

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CONTENTS.

EDITORIAL NOTES.

The New York Gas & Electric Light, Heat & Power Co.

Considerable interest is being taken in the New York Gas & Electric Light, Heat & Power Company, which was incorporated at Albany on October 3, with a capital of $25,000,000, and no one believes that the men whose names appear as the incorporators are in reality the financial backers of the enterprise. As is now generally known, the principal object of this company is the distribution of electricity for use in New York City. It has been rumored, and this rumor is undoubtedly founded on the large amount of the new company's capitalization, that a combination of plants already in operation has been effected or is in prospect. It is also thought by many that the Metropolitan Traction Company is back of the new project, especially now that the latter corporation is preparing to use electricity on most all of its lines. Another incident that would seem to strengthen the belief that the Metropolitan Traction Company is interested in the concern referred to is the fact that a large number of conduits are now being laid as speedily as possible along Broadway, ostensibly to furnish electric power for operating the Broadway line, but apparently of much greater capacity than is required for the car lines. President Vreeland when recently asked whether his company was not laying more conduits than were actually necessary for operating the cars, made the following statement, which appeared in the New York *Sun* :

"We are not. It may seem as if there were more conduits going down than are necessary, but there are not. In the first place, with the underground system it is necessary to have metallic circuits. That is, there must be wires running both ways, instead of only one, as is the case where the overhead trolley is used. It has been found impracticable in underground work to use the rails as a return conductor. This doubles the number of wires. It is expensive, but it is the only thing practicable. Besides, it does away with electrolysis, which in some cities plays such havoc with water and gas pipes.

"According to our plans the entire road, say the Broadway line, is divided into sections, each about 1,500 feet long. Each section is entirely independent of the others, and should it break down would not affect the road as a whole. This guards against long blocks, as the cars, once passed over the broken down section, would run along all right.

"The system is a good one, the only one practicable in a city like New York; but it necessitates the putting down of many wires. We are putting down a good many, but they will all be needed. On the Lenox avenue experimental line were first laid eighteen wires. Soon after we put down eighteen more, and before a great while eighteen more."

The conduits now being put down by the Metropolitan Company adjoining each track along Broadway are three and one-half inches internal diameter and range in number from eighteen to thirty-six. In spite of the above statement, and even granting metallic circuits are used throughout, from a rough calculation we have made it is difficult to see how, even under the most trying conditions, thirty-six conduits should be necessary.

As we understand it, the Metropolitan Traction Company proposes to generate the necessary power for operating its lines at its new power house now building at Ninety-sixth street and First avenue. This station will have a capacity of 90,000 horse-power and an alternating high tension distribution system will be employed. It has been claimed by some that the Metropolitan Traction Company is not in a position to dispose of current for power purposes even if it wished to, as it will require from 75,000 to 80,000 horse-power to operate the cars on its various lines, and that the difference between that and 90,000 will be needed for lighting purposes, etc. Even granting such to be the case, we do not see as this would prevent the Metropolitan Company from generating power at its present cable power houses at Houston street, Fiftieth street and elsewhere, and disposing of it to private consumers if it so desired. According to President Vreeland's statement, fifty-four conductors are ample to operate the Lenox Avenue line, and yet along Broadway there are at present being laid seventy ducts, each capable of holding at least one cable. With high tension transmission, moreover, the number of cables should be materially reduced as much less copper would be required than if a direct-current system of distribution were employed. A well-known builder of electric subways recently made the following statement, which appeared in the paper already quoted :

"Any novice can see that it would be a profitable venture for the Metropolitan to lay down a few ducts for rental. The standard rental for subways is $1,000 a mile per duct, and at this figure the Metropolitan could pay for its subway in a year if it rented it all, for a thirty-duct subway would bring $30,000 a year rental for every mile. In some sections there will be forty ducts, and in others many less. One can easily understand what a profitable arrangement it would be for a new light and power company to unite with the Metropolitan. Are they going to? That I can't say. I am in a position where I can't talk about this matter. All I can say is that the Metropolitan is laying a great many ducts."

Taking it all in all, we are rather inclined to be-

lieve that the Traction Company is in some way interested in the New York Gas & Electric Light, Heat & Power Company—if not, and if all the conduits now being laid along Broadway are necessary for operating that line, underground traction in New York City is decidedly an expensive luxury.

* * *

Lighting from Car Axles.

Since the general adoption of electricity for illuminating purposes, various attempts have been made to introduce this form of illuminant in railway trains. One means adopted for this purpose consisted in placing a generating set in the baggage car of a train and running it by steam taken from the locomotive. This necessitated coupling all the cars to be lighted by electricity in a train together by means of an electrical conductor. If for any reason it became necessary to detach a car from the train, in order, for instance, to switch it onto a different route, the lights in that car would immediately be extinguished. Some of the New York dailies have recently taken up this question of electric train lighting, and one of them after dwelling on the disadvantages of the baggage car dynamo system says:

"But now a new idea, simple but seemingly effective, has been put forward. It is to have a separate dynamo for each car, to be operated by a cog-chain run on a wheel attached to the axle of the car. The electricity is conducted to storage batteries and from them diffused throughout the car. Each car is then separate and independent in its lighting. Enough electricity is generated in a run of 150 miles to light the car during the trip and for six hours afterward. In daylight the current is used to operate ventilating fans."

From the way in which some of the dailies have discussed this method of train lighting one might be led to believe that the attaching of a dynamo to the axle of a car with a view to procuring electric current is an entirely new departure and has never been successfully attempted until now. This is however not the case. Three United States postal cars on the Atchison, Topeka & Santa Fe Railway have been equipped with a device of this nature for procuring current for lighting purposes since last March, and these cars are said to have been running regularly ever since between Chicago and Kansas City. Each car is provided with twenty-four 16 candle power lights, which are kept lighted while the car stands in the station by a system of storage batteries located on the car itself. On the first of last April there were fifty-four cars thus equipped running regularly on the Santa Fe system which from all accounts have given entire satisfaction. In the system here used the dynamo is fastened to a cross piece on the truck and operated by means of a belt passing over two different size pulleys. The arrangement of pulleys is such as to keep the speed of the armature of the dynamo as nearly constant as possible. Each car is likewise provided with an extra belt to replace the one in use in the event of its being lost. The replacing of a belt consumes but four minutes. The Pennsylvania Railroad, if we are not mistaken, already has several cars equipped in this manner, and the New York Central has one or more cars lighted from the axle. The idea of utilizing current generated from a car axle is therefore by no means new even on steam railroads, and the principle has frequently been made use of in trolley systems. In some street railway systems where a steep grade is encountered the motors on the cars have been made to act as generators and feed back current to the line. A novel idea would be to make use in some way of the enormous amount of energy lost in the frequent application of the brakes to the wheels on a railroad train. It might be possible to utilize at least a portion of this wasted energy in driving a small dynamo at each application of the brake shoe against the rim of the wheel. This is offered merely as a suggestion and as food for thought.

* * *

The New Battleship Illinois.

At Newport News, Va., on October 4, in the presence of thirty-five thousand people, the first-class battle-ship Illinois was launched. This ship, which was contracted for, together with the Alabama and Wisconsin, in 1896, will have when fully equipped a displacement of 11,525 tons, or 185 tons greater displacement than the Iowa and 1,225 tons greater than the Oregon. The armor of the forward conning tower will be ten inches in thickness. The tower itself will be oval in shape, seven by eleven feet in the clear, with a heavily armored tube seven inches in thickness extending down to the protective deck for the protection of the electrical conductors used in signaling. In all there will be about eighty auxiliary engines in the vessel for operating cranes, deck winches, pumps, windlass, steering gear, etc. The propelling power will be derived from two sets of triple expansion twin screw engines of 10,000 collective indicated horse power, each located in its own separate water-tight compartment. The steam necessary to operate these engines will be derived from eight cylindrical boilers. The latter will be connected in batteries of two each, each battery being located in a water-tight compartment. By this arrangement the chances of the vessel ever becoming entirely helpless are reduced to a minimum.

The electrical equipment of the Illinois will be most complete and thorough. There will be eight generating sets for supplying the enormous amount of current required in operating the searchlights, of which there will be four, ventilating fans, signal bells, incandescent lamps for ordinary illuminating purposes, bulkhead lamps, cargo reflectors and night signals. There will be but one main switchboard, from which the battle and lighting circuits will radiate. As already in the case of several of our naval vessels, the ammunition hoists on the Illinois will be operated by electricity, thus doing away with considerable cumbersome machinery. That the use of electricity as a motive power for heavy work on the new vessels of the United States Navy is increasing, slowly it is true but nevertheless surely, cannot be doubted, in spite of the opposition to this form of motive power by the advocates of steam and compressed air. As we pointed out in an editorial last week, the adoption of electricity on fighting ships has many advantages to recommend it, and as more care and pains are taken in the design of special electrical apparatus for use on shipboard, the number of installations will undoubtedly increase until every piece of machinery will be operated by this power, excepting of course the main propelling engines.

Under the Searchlight.

Notes and Comments on Various Topics.

THE news is being passed around that the Westinghouse Company has been awarded the contract for equipping a woolen mill at Tientsin, China, with electrical machinery. This is a new departure, and a great deal less repulsive than putting electrical equipments into the Parisian and Roman catacombs, or even setting up a dynamo in the Pyramid of Cheops.

* * *

SIR ELLIS ASHMEAD-BARTLETT's special pleading for Turkey at the time of the Armenian massacres and his eccentric conduct during the war with Greece, which subjected him to much ridicule, may after all result not only to his own advantage but also in breaking down some of the prejudice against modern innovations that is keeping Turkey in the background. He has been granted by the Porte concessions for electric lighting and traction in Smyrna and Salonica, and priority of right is promised him also in Constantinople whenever the Sultan makes up his mind to allow the use of electricity in his capital. Sir Ellis Ashmead-Bartlett, an American by birth, is an English M. P., and married the Baroness Burdett-Coutts.

* * *

A PROFESSIONAL school of electricity is to be established near Paris, France. The school is intended to furnish laborers and foremen with an electrical education, and first-class instruction will be given in both theory and practice.

* * *

FROM all accounts Emperor William of Germany does not intend to allow himself to be assassinated if he can prevent it, and with this object in view is said to cause the guards on duty at the imperial palace to carry telephone transmitters whereby warning may be sent of the approach of suspicious persons.

* * *

ANOTHER opportunity for inventive genius to display itself is presented by the Society for the Encouragement of National Industry, Paris, in its offer of various prizes to be awarded during the coming year. Among these is a prize of $600 in connection with the manufacture of permanent magnets; research in this case may be directed to the composition of the steel for the magnets and such materials other than iron which may enter into it, or to the degrees of temperature for the liquids used in tempering; also the processes of annealing and other necessary accessory operations which are likely to obtain this result. Another prize likely to call forth considerable effort is for an incandescent electric light, one not to exceed a maximum of two candle power—decimal system. Four hundred dollars are also offered for any set of electrical appliances or tools suited to domestic life and to small trade.

* * *

AN electric fan which had been put into the dining-room of a Washington residence was, the *Star* states, a matter of great interest to the colored attachés of the household :

One of them, a stout "auntie," stopped and gasped ostentatiously every time she passed before it.

"Whut de matter, Aunt Hannah?" asked the boy who was supposed to help around the kitchen and who was her especial aversion. "What makes you keep shyin' like a hoss?"

She disdained to answer, but chancing to pass the fan again, gave another gasp.

"Is you got de ast'ma, or is you jes' pantin' 'cause it's a wahm?"

"Sonny," she responded slowly, "I desires to ax you sumpin'. Is you fishin' foh trouble? Case if you is, you wants ter watch your cork. You's got a bite right now."

"No'ndeed. I isn' lookin' foh trouble. I was only 'quirin' aftuh yoh health an' comfort. I wanted to make sho' whether yoh wus a-skyaht o' dat fan."

"Me a skyaht o' dat?" she exclaimed with great contempt. "I's humiliated. Dat's whut I is. An' I guess dey is mo' service places dan dis, so's I won' hafter quit workin' when I's left."

"Is yoh gwine away?"

"I is."

"Whut's yoh dissatisfaction?"

"Laziness. White folks' laziness. I doesn' speck quality folks to wuck hahd. But dah's sech a thing as kyahyin' luxury an' ease too far for respectability. I doesn't blame 'em foh gettin' red o' de cookin' an' cleanin' an' passin' de dishes at dinner. But when dey gits so dey's got ter set up machinery to help 'em draw deir bref, I tells you, chile, dey's got clean past de limits ob gentility."

* * *

THE *Lady's Pictorial* describes an electrically propelled baby carriage, regarding which *Electricity* of London comments as follows: "It is intended that the nursemaid shall control the pace of this vehicle when the occupants are of specially tender years, but in time babies of due discretion will be entrusted with the management of their own perambulators. It would be difficult perhaps to devise a more effective training in the duties of citizenship and self-

government for the rising generation, but we old fogies will probably have an exceedingly lively time of it meanwhile; and to some of us it may seem that progress and the Zeitgeist are making undue demands upon our forbearance when we have our toes run over and ourselves knocked sideways by the emancipated babies. But we shall bear it with patience, I doubt not, in the sacred cause of Humanity—with a big H."

* * *

AN electric grate has recently been brought out The grate standing in a fireplace in the usual manner has within it an incandescent lamp over which is placed a wire cage at such a height in the grate that the imitation coal, composed of ruby and amber glass, when spread over it is brought up to the height of an ordinary coal fire. About as much heat is derived from this grate as from Mark Twain's stove with a candle in it. It therefore serves as an ornament for imaginative people.

* * *

Having Fun With their Electric Lights.

Some California towns are in a state of chronic irritation over their electric light service, and this is scarcely to be wondered at if the facetious comments the local papers print in regard to it are founded on facts and are not the figments of editorial fancy. The following appears in the Riverside *Enterprise* of a recent date:

The quality of the electric light service furnished by the San Bernardino people must belong to the same tribe of that supplied here, for the *Times-Index* says:

"The situation in regard to the city lighting seems to be growing worse and worse in place of better. The 10 years contract made with the San Bernardino Electric Light Company has yet nine years and several months to run, and at the present rate of illuminative attenuation, it is believed the darkness will become fully as dense as that of the Cimmerian desert long before the contract has expired. The charge is $6 50 a month for each dark light, and there are supposed to be 63 of these dark lights, although not more than one-half of them make even a painful and impotent stagger to shed the ghastly gloom for which they were put up."

The *Times Index* is too exacting. It grieves that only 30 out of 63 street lights burn. The rate of percentage would be considered a big thing in this city, where not a single street lamp out of 85 has done any shining for many moons, yet the taxpayers here paid $50,000 for their alleged system of street lights.

It seems, however, that the San Bernardino city trustees took some action in regard to the failure of the lights, for here is the *Times-Index's* record of the proceedings:

"And that grewsome, globular, nocturnal effulgence which casts spasmodic shadows on Court street is a particularly expensive luxury. It is of 2,000 flicker power, and at so much per flicker—well, it is something of a tax-consuming monster. When the matter was brought before the Cimmerian oligarchy, the latter just smiled and said: 'The public be ——! Let 'er flicker!'"

Here in Riverside no notice whatever in an official way has been taken by the trustees of the failure of the Redlands Company to fill its contract, a contract which it gave a bond to carry out. The city dads did not even think it worth while to make a statement to the taxpayers, as the San Bernardino trustees did, as recorded above.

The reputation of the light service of this city has even reached the sanctum of the Santa Ana *Blade*, for McPhee, n a late issue of his paper, expresses his opinion as follows:

"We just hate to exult over the troubles of any community, but in view of the manner in which the electric lighting plant of Riverside was held up to our people as the greatest and best thing on earth and a wonderful proof of the advantage of municipal ownership, we are tempted to say 'I told you so.' The great municipal ownership scheme for lighting the city of Riverside has turned out to be anything but a success. During the day Riverside is as well lighted as any place in the country, but at night—that's different."

Electric Sterilization of Water.

The water taken from the Bruges Canal at Schoorebrugge is first filtered in the usual manner through beds of different kinds of sand, and is finally pumped through sterilizers, being there subjected to the influence of an electric current at a pressure of 1,000 volts. It is stated that by this means all traces of microbes are entirely destroyed, and the pure water is distributed to the inhabitants of Blankenberge by means of the system previously in use. About 35,000 cubic feet are treated per day in summer, this value falling to about 10,000 cubic feet per day in winter. The electrical installation has an output of 55 HP.

Light-Electric Telegraphy.

Prof. Zickler of Brünn has conducted an elaborate series of experiments which show that a telegraphic instrument can be actuated at considerable distances by a beam of ultra-violet light. He employs a powerful arc lamp as his transmitter, using a screen of glass to produce intermittent flashes of the ultra-violet beam, which embody themselves as dot and dash signals on his receiver. The receiver is an air-gap in a circuit containing an induction coil regulated to an EMF. just below the sparking point at the air-gap. As Hertz long ago has shown, a beam of ultra-violet light falling on the cathode of a strained air-gap, near its breaking down point, will immediately provoke a discharge. Zickler started by producing this effect over a distance of 2 m. Then, by improving the shape and material of his electrodes and enclosing them in a chamber of compressed air, he was able to increase this distance to 200 m. This is a remarkable result, and it is extremely interesting to physicists to learn that the short and easily absorbed ultra violet light can influence a spark discharge at so great a distance; but to think of this as a practical system of wireless telegraphy, as Prof. Zickler appears to do, is a *reductio ad absurdum*. The light within the limits of the visible spectrum which an arc emits will do all the signaling that the ultra-violet beam is capable of, will penetrate to much greater distances and can be manipulated with much simpler apparatus. The ether waves of the visible spectrum which Nature has successfully used for signaling since the creation are in danger of being rejected for our new ones, ultra-violet or Hertzian waves, which Nature probably long ago tried and found wanting.—*Electrical Review, London.*

THE JUNGFRAU RAILWAY.*

The first section of the electric railway up the Jungfrau was opened Sept. 19. We had the good fortune to inspect the line a few weeks ago, and we make use of this opportunity to publish a description of it.

The Jungfrau is one of the highest of the Swiss mountains, its summit being 13,670 ft. above sea-level. It is the highest of the group Eiger, Mönch and Jungfrau, which is considered by some to be the most beautiful of the Swiss snow mountains. The grandeur of the glacier region which surrounds it, and the magnificent panorama that can be obtained from the summit, have made the Jungfrau a favorite among mountaineers, but to ascend it a night has to be spent on the mountain and it must be reckoned among the big climbs of the Alps. Having already referred from time to time to the inception and progress of the project for building this railway, a

FIG. 1.—VIEW OF THE JUNGFRAU FROM THE LITTLE SCHEIDEGG STATION.

scheme which was originated by Herr Guyer Zeller, president of the Jungfrau Railway Commission, we will now confine ourselves to a description of the line itself and the works in connection with it.

Fig. 1 is a view of the mountain from the Little Scheidegg station of the Wengern Alp Railway. The Wengern Alp Railway is a rack and pinion railway driven by steam locomotives. It starts from Lauterbrunnen and ascends the Wengern Alp to the Little Scheidegg (an elevation of 6,770 ft. above sea-level), from whence it descends on the other side of the mountain to Grindelwald. The Jungfrau electric railway starts from the Little Scheidegg station of the Wengern Alp Railway and ascends the Jungfrau from the north side. It may be mentioned incidentally that tourists have nearly always climbed the Jungfrau from the south side as the route from the Little Scheidegg is very hazardous for pedestrains. Fig. 2 is a perspective sketch of the Eiger, Mönch and Jungfrau showing the direction of the existing Wengern Alp Railway in a dotted line, the first section of the Jungfrau railway from the Little Scheidegg to the Eiger Glacier station as a full line, and the remainder of the railway, which is

* From the *Electrician*, London, Sept. 23.

under construction, dotted. A table of the projected stations, with elevations, distances and gradients, is given below.

On the section of the line already opened there is only a distance of about 85 yards in tunnel, but from the Eiger Glacier onwards the railway will not touch the surface except at the stations. Almost immediately after leaving the Little Scheidegg station the gradient is 10 per cent., and this is increased to 20 per cent. at about half-way to the Eiger Glacier station. From this station the gradient increases to the maximum of 25 per cent. and the line enters the long tunnel, about 450 yards of which has been driven up to the present. The remaining stations from Eiger Wand onwards will be built within the rock, and it is intended to fit them with restaurants and sleeping accommodation for those passengers who may wish to break the journey. From the Eiger Wand and Eismeer stations there will be no egress on to the mountain, and tourists will merely be able to enjoy the view from windows or balconies, but from the Jungfraujoch station it will be possible to go out on to the Jungfraufirn and sledge over the perpetual snowfield to the Aletsch Glacier. It is expected that this station will be made use of to a considerable extent as a starting place for tours. It had been originally intended to have an open station on the Mönchjoch (with possibly a branch line to the summit of the Mönch) which would have been situated between the Eismeer and Jungfraujoch stations, but at a higher level than either. This was, however, abandoned on consideration. Had there been a failure of current after a train had passed this station it would have been impossible for it to descend to the Little Scheidegg merely by using the brakes, and the train would be delayed in the mountain until the interruption of supply was made good. According to the present scheme there is no change in the sign of the gradient, and passengers would be able to return to the starting point if there were a breakdown of the line or in the power-house.

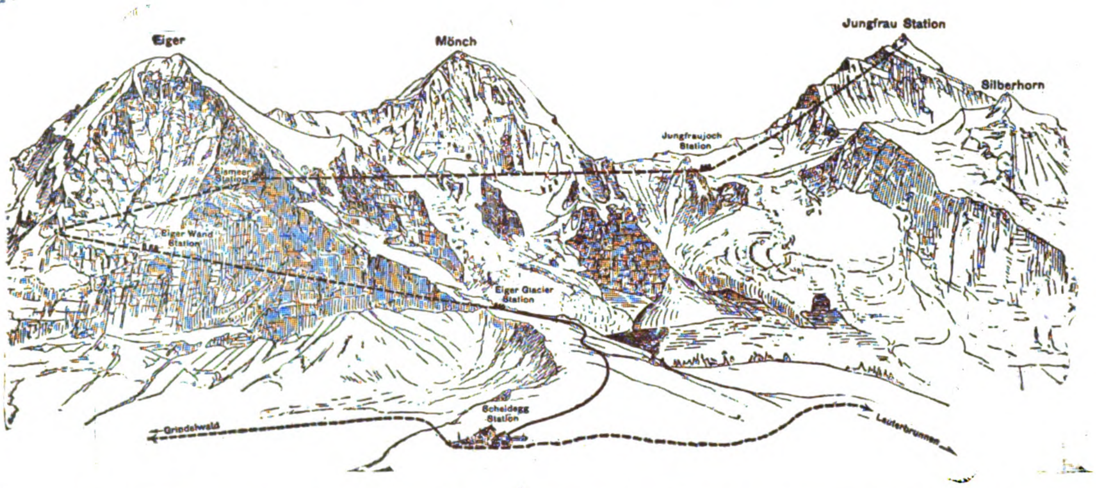


FIG. 2.—SKETCH OF THE JUNGFRAU GROUP, SHOWING THE ROUTE TO BE TAKEN BY THE RAILWAY.

The Jungfrau line is one of the most interesting applications of three-phase transmission and distribution yet made. Water-power is made use of in the valley to generate three-phase current at 7,000 volts, and this is transmitted by means of overhead wires to transformer stations at the Little Scheidegg and the Eiger Glacier where it is transformed to 500 volts by means of stationary transformers. Not only is electrical energy employed for traction purposes but also for lighting, heating and for working the rock drills used in the tunnels. When the railway reaches a certain altitude, the energy expended in heating the trains and stations will be an important item of the total cost.

At present only one power-house has been built, this one being situated on the White Lütschine, near Lauterbrunnen, right down in the valley. The power transmission line from Lauterbrunnen to the Little Scheidegg is about $4\frac{1}{2}$ miles long. The ascent of this $4\frac{1}{2}$ miles by foot takes about three hours—an hour and a half by the rack and pinion railway—the difference in level being about 4,250 feet. The three wires are of bare hard-drawn copper wire 7.5 mm. diameter. They are supported on large earthenware three-lipped insulators of about $4\frac{1}{2}$ in. diameter and 7 in. high. Stout wooden poles, about 33 ft. long, are used, with galvanized iron brackets. Wherever the wires cross a footpath they are nearly surrounded by a circular guard-net of very wide mesh, intended to prevent a wire from falling to the ground in case of breakage. A metallic circuit telephone line is fixed on the same poles, some distance below the three-phase wires, and the two telephone wires are crossed every 550 yards to prevent induction effect. As a matter of fact, this proves to be insufficient protection from induction noise, and it will be necessary to cross the wires more frequently. Lightning protectors of the Siemens & Halske horn-shaped pattern are used on each of the power wires and at each end of them, and similar lightning protectors are applied to the secondary wires. The fall of potential will be about 10 per cent. at full load.

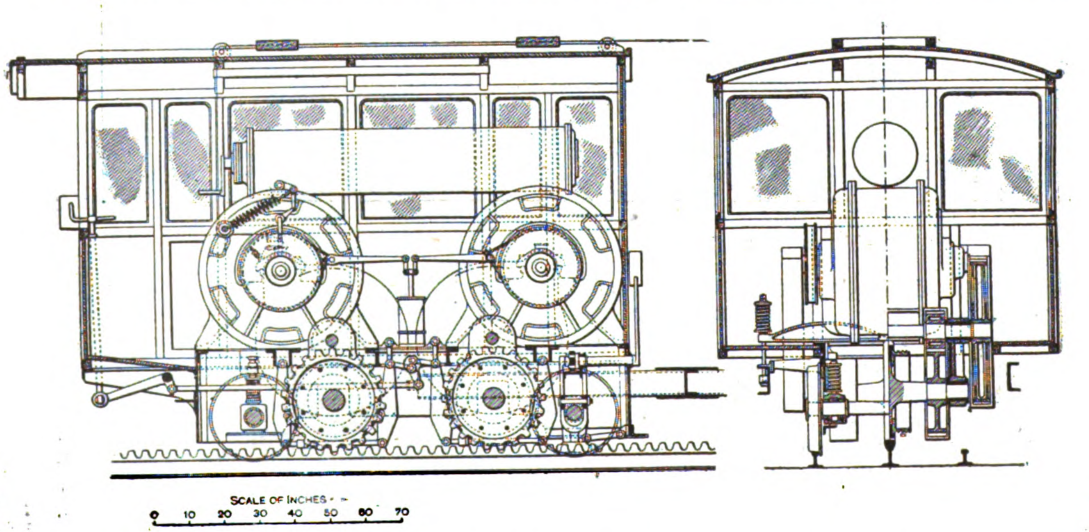


FIG. 3.—ELEVATION AND SECTION OF LOCOMOTIVE, SHOWING GEAR.

The transmission line is not duplicated, so that if it were interrupted all power would be cut off from the railway. A duplicate power station is projected however at Burglauenen, near Grindelwald, on the other side of the Wengernalp, capable of supplying some 2,600 HP., which is to be furnished by the Black Lütschine. This will feed the Little Scheidegg transformer station through a quite independent transmission line of similar construction.

The sub-stations are substantial stone buildings, designed to withstand the action of the most inclement weather. They are each fitted with two 200-kilowatt transformers, reducing the pressure to somewhat over 500 volts for the secondary feeders. The latter are of 9 mm. hard-drawn copper and are constructed in a similar manner to the transmission line. The transformers are built by the Oerlikon Co. The fuses are of copper wire outside the sub-stations. In addition there are rotary transformers at the Eiger Glacier station, which supply continuous current for the rock drills and lighting. When more of the line is built, transformers will be added every kilometer (1,094 yards).

The permanent way is built on the Strub rack

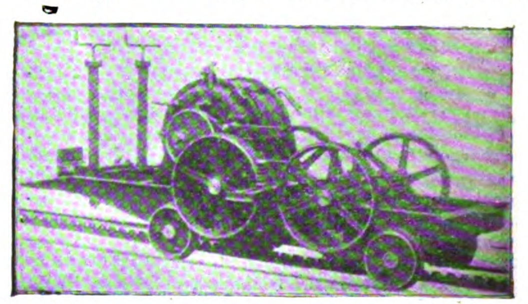


FIG. 4.—LOCOMOTIVE TRUCK.

system. Meter gauge (3 ft. $3\frac{3}{8}$ in.) is employed, the rails being of the usual Vignoles profile, $3\frac{15}{16}$ in. high and weighing 40 lbs. per yard. The length of the sections of rail average 34 ft. 6 in., and steel sleepers are used, their distance apart averaging about 3 ft. 3 in. The rack, which is as usual half way between the rails, is of rolled steel. It is rolled solid and the teeth are cut afterwards in the cold bar. It is made in lengths of 11 ft. 6 in., and weighs only $68\frac{1}{2}$ lbs. per yard. Its mean tensile strength is $28\frac{1}{2}$ tons per sq. in., with an elongation of 20 per cent.; the same clips are used for the rails and rack. The conical shape of the teeth of the rack permits the use of an emergency brake which clutches them on both sides. As has been already mentioned, one section of the projected line will have a gradient of only $6\frac{1}{4}$ per cent., and here it is anticipated that no rack

Stations.	Height.		Distance.		Maximum gradient. %.
	From station to station Feet.	Above sea level. Feet.	From station to station Miles.	From start. Miles	
Little Scheidegg......		6,770		0	
	840		1 2		25
Eiger Glacier...........		7,610		1 2	
	1,610		0 9		25
Eiger Wand..............		9,220		2.1	
	1,140		1.5		25
Eismeer..........		10,860		3.6	
	850		2.6		6¼
Jungfraujoch		11,210		6.2	
	2,720		1.7		25
Lift......................		13,430		7.9	
	240		...		100
Summit of Jungfrau..		13,670		7.9	

It is estimated that the railway will be completed by 1904.

will be needed. The sharpest curve of the section of the line now opened has a radius of 33 ft., and the

sharpest curve in the tunnel will have 66 ft. radius. Two Chicago bonds of 7 mm. copper are used for each rail-joint, and the rails are cross-connected every 55 yards with 8 mm. copper.

We give several views of the first locomotive built

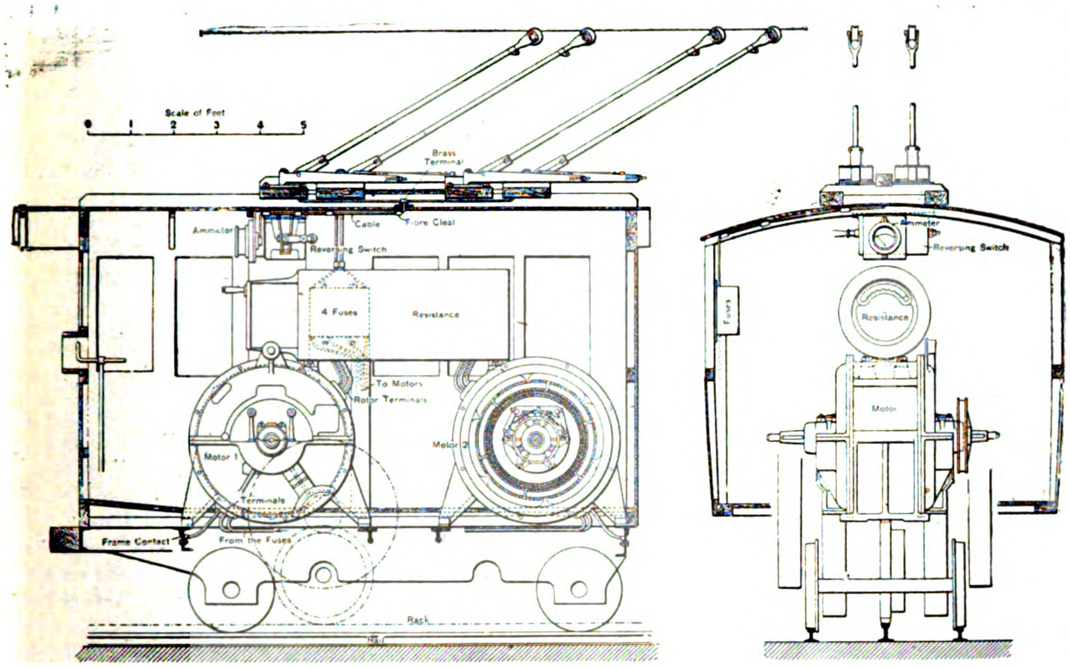


FIG. 5.—VIEW OF LOCOMOTIVE, SHOWING ELECTRICAL EQUIPMENT.

for the line. Fig. 3 shows the arrangement of gear; Fig. 4 is the truck with one motor removed; Fig. 5 shows the electrical equipment, and Fig. 6 a view of the line, showing the overhead equipment. The

FIG. 6.—PART OF THE FIRST SECTION OF THE JUNGFRAU RAILWAY.

locomotive contains two 125 to 150 BHP. induction motors driven directly at 760 revolutions per minute by the 500-volt three-phase current with a frequency of 38 cycles per second. The weight of each motor is 2.6 tons, and the locomotive complete weighs 13 tons. The construction of the four-wheel truck and the gear are clearly seen in Figs. 3 and 4, which are self-explanatory. Fig. 7 shows the electrical connections. The great advantage of the three-phase system on such a railway is the simple automatic breaking action of the induction motors. When the locomotive is going down hill the stators of the motors cannot greatly exceed the speed of synchronism. From the plan of connections it is seen that the motors are merely controlled by a reversing switch (through which the stator is connected to the line) and the usual rheostat in the rotor circuit to avoid starting the rotor on a short circuit. The locomotive is fitted with three absolutely independent brakes. The first is an automatic one, electrically controlled. By means of a centrifugal governor, when a speed greater than a certain maximum is reached, the current is automatically switched off from the motors, and at the same time a hand brake is actuated. A dashpot prevents slight momentary increases in speed from putting the brake in action. This brake can also be applied by the guard in the passenger car, who is provided with a switch to switch off the current. The second brake is a hand-brake, which applies bronze shoes to a wheel on the driving axle, and the third, which has been already referred to, is an emergency brake which grips the rack. This brake is also lined with bronze. It can be applied either by the driver or by the guard. There are six incandescent lamps on the locomotive, two in series on each phase, and the passenger car will be lit with fifteen lamps, five between each pair of wires. Two trolleys are employed on each wire on account of the large currents which have to be transmitted to the locomotive.

The passenger cars, which cannot be called trailers, as they are pushed not pulled, are built for 40 passengers. These cars had not yet been delivered when we viewed the line. Each train will usually consist of a locomotive and one car, but at times of exceptional traffic another car will be added. At present only two trains will run, one up and the other down.

Before descending to the power house in the valley it will be of interest to refer briefly to the work which is being done in the great tunnel. At the

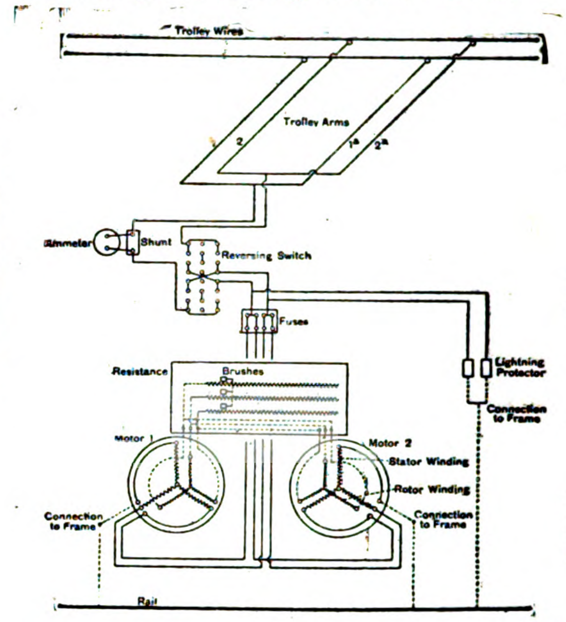


FIG. 7.—CONNECTIONS ON LOCOMOTIVE.

time of our visit 60 workmen were being employed in the tunnel, and 400 in all. Most of the navvies and laborers are Italians. They are provided with food and lodging in barracks built on the mountain for that purpose, and the tunneling work is continued during the winter. As has already been mentioned, electricity is used to work the rock-drills. Both rotary and percussive drills are used. The latter make 400 strokes a minute with $4\frac{3}{4}$ in. stroke. The rotary drills are fitted with 3 HP. motors, and have a self-acting feed of 2 mm. (0.08 in.) per revolution.

(To be continued.)

ELECTRIC MOTORS IN A TANNERY.

A new application of electricity as a motive power has recently been adopted in the tannery of Messrs. Dunn Bros., Cork, Ireland. Of late years, in the early stages of the tanning process, steam power has been largely used to agitate the leather suspended in tanning liquor, the object being to promote the tanning. Various mechanical appliances have been adopted. The American rocker system, so largely used in the United States, has been for years in operation at Messrs. Dunn's tannery, the necessary motion being given by eccentrics on a shaft driven by a steam engine. Each rocker consists of a strong wooden frame at the top of a tanpit supported on pivots and free to move about 6 inches in a see-saw fashion. From this frame the leather to be tanned is suspended in the tanpit, which is filled with tanning liquor. When the frame rocks the leather is gently agitated in the liquor. Experience proves that the best results are obtained with an intermittent motion.

With the usual arrangement, it is necessary that the starting and stopping should be done by some one on duty for that purpose, and consequently the intermittent motion cannot be continued during the night without considerable extra expense. In the new arrangement, electricity developed by a dynamo driven by a steam engine, is stored in accumulators. A clock turns a commutator, which at intervals switches on a weak current that works a relay which

switches on the full power of the accumulators to a motor which rotates the shaft moving the rockers. The commutator being connected with the minute hand of the clock turns on the electricity for some minutes every hour during the day and night. In this manner alternate motion and rest, found to be so desirable, is automatically produced during the night as well as in the day. In this tannery there are 20 of these rockers, each capable of carrying 50 butts or hides.

The great economy of power obtained by the use of electro-motors is very well exemplified in this instance. The whole set of 20 rockers contained at the time of test about 800 hides or butts worked with 26 volts at the accumulators and a current varying from 14 to 18 amperes, or an average of 410 watts or less than half a unit per hour.

The motor and gearing have been made with special regard to economy in working and possibility of increasing the power if required, by simply adding to the number of cells in the accumulator. Attempts of various kinds have been made to accelerate the tanning of leather by electrical means, some of these systems being electro-chemical modifications of the ordinary process. Dunn Bros.' improvement leaves the tanning process unaltered though expedited. The users of the leather therefore will find it exactly the same as formerly in quality, texture and appearance. It has been an objection to some of the new processes that the resulting product has differed in some of these particulars from the leather to which customers are accustomed, and on which they have found that they can rely.

The machinery in this tannery is of the most modern type. The electrical system of working the rockers now described is the subject of a patent.—*Electrical Review, London.*

ON THE ELECTROLYTIC CORROSION OF WATER AND GAS PIPES BY THE RETURN CURRENTS OF ELECTRIC TRAMWAYS.*

BY DR. J. A. FLEMING, F. R. S.

(Concluded from page 199.)

Let us consider next the electrical conditions in the neighborhood of an electrical overhead system of street railways. In all cases where the uninsulated tram rails are used as a return it is unquestionable that some fraction—perhaps, a large one—of the return electric currents will come back through the earth from the distant or more remote portions of the track to those near the generating station, no matter how well bonded the track may be. The exact distribution of this current flow through the surrounding subsoil it is impossible to determine, but if there is a current at all it involves as a corollary the existence of lines of current flow and orthogonal equipotential surfaces.

We may roughly represent by a diagram the general electrical conditions. Suppose a generating station to be at G and T to be the trolley-line and H G the rails. When cars are in operation, current is being discharged at various places into the line. The end H is at a higher potential than the end G. The Board of Trade regulations permit a maximum of seven volts for this total rail fall. The results will be that through the earth we have a distribution of current flow lines. The terminations of these lines accumulate near places where the cars happen to be, and move with the cars. Orthogonally to these flow lines, or at right angles to them there are equipotential surfaces which are shifting about in the earth as the cars move along. The disposition of the current lines will be modified by the presence of pipes in the ground, in so far as these are conductors, also by the electrolytic counter-electromotive forces.

If, then, subterranean pipes exist in the region occupied by this return flow, and if these pipes have their extremities on different equipotential surfaces, it is certain that current flow must take place through these pipes if they have any longitudinal conductivity, and no amount of conductivity in the soil short of infinite conductivity will altogether prevent this from happening. The proof of this is found in a very simple experiment. In a large vessel containing an electrolyte, say dilute acid, two electrodes are inserted, by means of which a current can be passed through the liquid mass. Two lengths of insulated copper wire have their ends just stripped to lay bare the wire, and are then twisted together to within a couple of inches of the ends. These ends are spread out at right angles. The other extremities are connected to a galvanometer. If the spread out bare ends of this galvanometer wire are dipped in the electrolyte it will be found that a current passes through the galvanometer one way or the other, according to the position of the collecting end. If the spread end is placed so that it is at right angles to the line of the current flow, then no current will flow through the galvanometer. The explanation is, of course, obvious. If the extremities of the exploring wire lie on different equipotential surfaces of the electrolyte when traversed by the current, the galvanometer, of course, indicates a current. If the ends lie on the same equipotential surface, then the galvanometer indicates no current. After the test wire has been employed in this manner it will be found that on stopping the main current the galvanometer gives a transitory reverse current, due to polarization of the electrodes.

In the case of long electric street railways worked on the rail return system it is unquestionable that the difference of potential between the different portions of the track when cars are running involves as a certain consequence the flow of current through the earth, however efficiently the rail bonding may be carried out. Mr. H. F. Parshall has stated (*Proceedings of the Institution of Civil Engineers*, April, 1898) that in tests carried out on an eight-mile track, cutting the rails at the center and inserting an ammeter, showed that 60 per cent. of the current was returning through the earth itself.

I think it will be agreed that it is exceedingly important, in the interests of other industries besides the electric traction industry, that in those cases where this earth flow occurs we should endeavor to find out where this current is going and what it is doing.

It is a matter of great difficulty to carry out experiments on actual electric street railway lines. We cannot always be cutting rails, and we certainly cannot cut gas and water pipes to ascertain the currents which may be flowing in them. I have, therefore, directed my attention to making a sort of working model of an electric traction system with an earth return, and of such a kind that pipes or equivalent conductors can be buried in desired positions, and an electrical survey made of the whole arrangement.

The model is made as follows: A large wooden box is provided, best made of paraffined or well-varnished deal. This box may be any desired size, but is best made square and of a depth equal to half the length or breadth. This box is filled with sea sand or river sand mixed with a little salt to give better conductivity and so compensate for limited dimensions, and the whole mass is moistened with water until it is thoroughly and uniformly damp but without free water on it. The resistance of such a mass will be about 1 ohm per yard cube between opposed surfaces. On the surface of this sand, which represents the earth, conductors can be laid down to imitate an electric tram-line. I have found it convenient to employ rods of plumbago and clay by which the required resistance and current carrying power is obtained. A pair of these rods connected in parallel by platinum wires may be laid down to imitate the line. A fall of potential along the line may be made equal to, say 7 volts, or to the maximum fall permitted by the Board of Trade, by attaching the terminals to a battery of four or five secondary cells to the ends of the line. If an ammeter is included in this line circuit, it will be found that the total current taken is greater when the rods are laid on the damp sand than when they are bodily lifted up. This difference indicates the earth return current. In order to explore the distribution of current through the mass of the "earth," a galvanometer or voltmeter is provided, having flexible leads, and the ends of these attached to two insulated wires twisted together, the other extremities being bared and splayed out to form a sort of fork.

In the sand, then, can be buried, at a slight depth, thin iron or lead wires or tubes, to represent gas and water pipes, and these can be given any required form and arrangement.

An electrical survey can then be made with the voltmeter. If a "pipe" or wire representing a pipe runs nearly parallel to the "line" it will be found that at one end of the line the "line" is positive to the pipe, and at the other that the pipe is positive to the "line." In my own model I have found that the potential differences of such a "pipe" and the line amount to 1 or 2 volts, just as they are found to do in the case of real electric street railways when measurements are made between the rails and a parallel buried pipe.* In the case of the pipes running parallel to equipotential surfaces the potential differences between all parts of the pipe and any one point of the line are nearly the same. By means of the exploring or testing fork it is easy to show that the earth return current flows through the whole mass of the sand, and with a little trouble the general form of the equipotential surfaces can be ascertained.

If the wires representing "pipes" are bent so that they have a loop in them which emerges above ground, this loop can be cut, and a sensitive ammeter or galvanometer inserted, so as to indicate the current flowing through the "pipe." In this manner it can be proved that when a pipe runs approximately parallel to the track, and when it is found to be positive to the rails near the generating station, and negative to the rails at distant points, there is a current flowing in the pipe from the far end towards the station end. If the pipe runs more or less transversely to the line then little or no current will appear in it.

In the case of actual pipes and real street railways it is an impracticable matter to make such tests as shall show whether there is a current flowing in the pipe or not. We can only infer its existence when electrolytic corrosion has made its appearance.

From experiments made with the above model, I am led to believe, if pipes or wires were laid down imitating the form or arrangement of the actual main pipes, and if a track were laid down imitating the plan of the real track, that useful information might be gained as to the localities, if any, in which electrolytic trouble may be expected.

It is, of course, obvious that a model on a limited scale can only very roughly represent the true state of affairs. In any actual case it is an exceedingly difficult, if not impossible, matter to predict the path along which the earth return current will distribute itself. It depends on unknown conditions as to rock and soil conductivity due to moisture, geological formations, subsoil water, infiltrations of sewage, brine springs, the conductive effect of buried pipes, leakage of water, gas and the nature of the car traffic at the moment. There is, however, a drift of current through the earth from the most

* Paper read before the British Association at a joint meeting of Sections A and G, Bristol, Eng., Sept. 12, 1898.

* If the "rails" in the model are made of carbon and the "pipes" are made of iron wire, there will be a constant potential difference between them of about 1 volt, due to the carbon, damp sand and iron forming a voltaic couple. This constant potential difference, however, can be taken into account in measurement, and does not interfere with the detection and measurement of those potential differences set up by the flow of current through the sand, which is originated by the external electromotive force.

distant portion of the line towards that point or points where the negative dynamo terminals are attached to the rails. The question of pipe corrosion is wholly bound up with the degree to which this return current takes advantage of pipe conductivity to help it on its way or is carried by the pipes as well as by the earth. This is not prevented by the fact that the earth resistance, taken as a whole, may be very much less than that of any line of pipe, but it is affected to a considerable degree by the resistance due to pipe junctions, or to the surface resistance afforded by oxidation of the pipes by which the entrance of current into them is hindered. The above statements can be proved by the use of wires imitating pipes badly jointed or partially insulated, and buried in the sand of the model electric railway just described, and a model of the above kind proves itself to be exceedingly useful for lecture or demonstration purposes in addition to its employment as a means of testing theories.

It appears, then, that the following statements may be taken as correctly representing facts in the case of electric street railways having uninsulated rails used as a return circuit:

(i) No amount of bonding of the rails, if uninsulated, will entirely prevent the flow of current through the adjacent earth, when there is any difference of potential between different parts of the line, and even with good modern bonding, or even continuous rails, a fraction, not inconsiderable, of the whole outgoing current may return by the earth.

(ii) Some portion of this current will pass through subterranean pipes, the amount being determined by—

(*a*) The general or local subsoil conductivity.

(*b*) The electric conductivity and continuity of the pipe lengths and depending on joints and material.

(*c*) The length and disposition of pipe, and its position as regards the average equipotential surfaces in the earth, when the line is working.

(*d*) The condition of the pipes as regards oxidation or incrustation with non-conducting oxides or protective covering. The position which seems most likely to be favorable for the passage of current into the pipe is when it extends for some distance parallel with the rails and passes near the point of junction of the return feeder to the power station and the rails, and when it is new or fairly clean and well jointed—all conditioned, of course, by the general earth conductivity.

(iii) The danger areas are those regions in which the pipe current, if it exists, leaves the pipe to get back into the rails or return feeder, or even into the same pipe again, but mere difference of potential between the pipe and the rail is not in itself a source of danger to the pipe. There must be, in addition, electrolytic conduction of current out of the pipe into adjacent soil which contains electrolyzable salts and the necessary moisture.

(iv) If electrolytic conduction out of the pipe exists at any places there is no absolute security in the Board of Trade limit of 1.5 volts for the potential difference of pipe and rail, except in so far that the less the voltage the less rapid will be the damage. Electrolytic corrosion may take place when only a small fraction of a volt difference of potential exists between the iron pipe and the adjacent portions of the rail return.

(v) The conditions most to be feared as provocative of pipe destruction are when certain local soil conditions exist near the places where the pipe is most positive to the rail. The presence of soluble chlorides in the soil, produced by sewage, brine springs, infiltration of sea water, if near the sea, solution of chlorides of sodium, potassium or magnesium or other salts present in the soil produced by water due to pipe leakage or natural accumulation by rainfall saturating the soil, set up at once conditions permitting electrolytic conduction, and the resulting liberated acid or chlorine ions attack the cast-iron pipe. In rapidity of destruction under this action, a new clean pipe may possibly succumb even sooner than an old one protected by a dense adherent coating of oxide, which is not a very good conductor. The time which any such action takes to reach a stage destructive to the pipe will be obviously less the more the electrolytic action is concentrated on a limited area of pipe surface.

In designing an uninsulated rail return traction system, the probability of the above-mentioned conditions occurring should not be ignored. Even if actual perforation of the pipes does not occur, there may be an "ageing" action which shortens the life of the pipe.

(vi) As the conditions determining possible pipe corrosion are numerous and not at all easily predetermined, it is important in the case of every electric traction system with uninsulated earth returns that an electrical survey should be made at intervals, setting down on a plan, showing rails and pipes, the potential difference between them at various places. Within the danger area a close watch can then be kept, whenever the ground is opened up for any purpose, for evidence of destructive electrolytic action on buried pipes.

In the above short summary of the causes and conditions of pipe electrolysis, no reference has been made to the question of remedy when it is found to exist. To deal with this portion of the subject properly would require more time than is at present at my disposal. All that has been here attempted is to show that, even working under Board of Trade regulations, it must not be assumed that the danger does not exist.

ELECTRICITY IN MODERN SURGERY.

Address by Dr. C. R. Dickson, of Toronto.

The following is part of an address delivered by Dr. C. R. Dickson, of Toronto, president of the American Electro-Therapeutic Association, at the recent meeting of that organization in Buffalo, and is of interest as shedding light on a subject which is as yet not thoroughly understood by the general public:

"For many years past the thoughts of those who are interested in the many branches of this wondrous subject, electricity, have turned to Buffalo, and it has been the Mecca of the Electric Pilgrims. On its outskirts the wildest dreams of the Arabian Nights have been outdone. Science, ever triumphing over nature, has harnessed that most beautiful of all nature's handiwork, and as though by the subtle touch of the magician, the very country has been transformed and solitary fields have become veritable hives of human industry, the outcome of the mighty power of Niagara transformed and transmitted. Massive factories are run on every side where but a few short years ago were found naught but vacant lots. To us, witnessing it for the first time, it is a milestone of progress, illustrating man's ingenuity, the triumph of his brain.

"The necessity for the existence of such an association as ours has been questioned, not only here but elsewhere; hence it may be necessary to explain our position. It has been asked 'Why should there be such an association? Electricity is only one of many therapeutic agents, and it would be absurd to have a separate association to consider each therapeutic agent.' At first glance this may seem a quite rational question. Our colleges teach us how to administer opium and its various derivatives, therefore the necessity for an opium society does not exist; but do our colleges teach us anything about electricity worthy of the subject? The answer to this question is quite unnecessary in the presence of the members of our association. Anyone should be depended upon to prescribe and administer the ordinary, or even extraordinary, remedies to carry out any regulation form of treatment. But I, for one, should fear to trust myself to the tender mercies o the general practitioner of to-day, did he in his wisdom consider it necessary to use this agent, electricity, unless he had paid some special attention to the mastery of it. The contention is an absurdity unworthy of America, the vaunted land of progress, and of Buffalo, the electrical city. In my own benighted land, even we are more enlightened than that. This is an age of specialism.

THE AGE OF SPECIALISM.

"The old-time practitioner, then the physician and surgeon, seems passing away. Surgery is being divided and subdivided, until at one time we feared that we were to be confronted with an appendix surgeon. Our patients are reaping the benefit of all this. Why, then, should we call a halt? No! Let onward be our cry. The time is past when a physician, the proud possessor of a magneto-electrical machine turned by a crank, considered his armamentarium electricum quite complete. One has but to glance at our programme to see to what extent electricity may be used, and used to advantage. A programme such as ours should prove a perfect revelation to him who has not kept well up to this progressive age. Could such a programme or one-hundredth part of it be intelligently discussed in any other existing society to-day not dealing distinctly with the subject? No! I greatly fear it would be a hidden book, a stumbling block.

"The hope of the future now lies in those who are thronging wisdom's halls, and it is a subject for congratulation that this association is to be asked to take action, bringing the needs of the hour before the authorities competent to deal with them. The student with mind as yet unwarped by prejudice must be in a position to obtain a comprehensive, intelligent grasp of the whole subject, that he may turn his theories to practical account in his professional career. But even he, unless endowed by those inestimable blessings, common sense, patience and gentleness, will find his efforts unavailing, and he must be a close observer of nature and her laws, seeking to assist rather than to combat her. Electricity is an agent most powerful for weal or woe. A great responsibility rests upon our educators, and the sooner they awake from their strange lethargy the better will it be for our reputation as an enlightened, progressive, scientific profession. The commercial world has taken such advantage of the rapid strides of electricity as a science with fixed laws that we have laid ourselves open to the charge of neglect. Let us hasten to make amends for the past, and remove some of the reproaches that rest on this, the noblest profession in this fair world.

OBJECT OF THE ASSOCIATION.

"Our association was organized some eight years ago because it was felt that the subject of electro-therapeutics could not be discussed in any existing society in a scientific and practical manner without controversial digressions of no value whatever. It was felt and felt strongly, that electricity had been left too long to the charlatan, the incompetent and the unscrupulous. It was also felt that we had another foe of hardly less dangerous character, the overzealous.

"To combat all these and cultivate and promote knowledge of electricity wherever it can be of service in medicine and surgery is the object of our association. It must be admitted that we are setting about this in the most practical manner possible. In fact, I know of no other association in which more practical or more useful work is being done. To carry out this idea successfully we have associated with us other than purely medical practitioners, and the association has proved a most happy one and fruitful of nothing but good. Thus the electrical engineer and expert study electricity's laws and note its action upon inert matter. The biologist and physicist go a step farther and study these laws in their action upon living tissue, and their labors are turned to practical account by the physician and surgeon.

"The clouds are breaking on our horizon. On my side of that imaginary boundary line we find increasing interest being manifest, and it gives me the greatest satisfaction to say that my own warmest friends in the city of my adoption are the men who stand in the front ranks of medicine and surgery, and electro-therapy has a recognized standing, inasmuch as special departments devoted to it are to be found in our public hospitals. I have had the honor to organize and now to preside over four such departments in as many hospitals, and more intelligent inquiries are being made by the students of the various medical colleges, all of whom have access to my clinics."

ELECTRIC LIGHT AND POWER AT THE HOFORS IRONWORKS, SWEDEN.*

Amongst the various works visited by the Iron and Steel Institute in Sweden last month, those of the Hofors Ironworks were, perhaps, the most interesting. These works are the oldest in the province of Gestrikland, and were founded in the beginning of the seventeenth century. Hofors and many other small ironworks in the neighborhood got their ores from the Torsaker Mines, which were quite sufficient to meet the small requirements in old times. However, as the output from blast furnaces and forges grew, also ores from Norberg, and later on from Bispberg and Wester Bergslagen, began to be used. The works have grown most rapidly, as all new improvements in iron manufacture have been adopted. The power for the works at Hofors was at first obtained from a 92 ft. fall near by, but with extensions the water available proved insufficient. More power was therefore secured by an electrical transmission scheme from a waterfall of 100 ft. at a distance of about 1½ miles from Hofors. There six turbines furnish a total of 1,400 HP., which is used for the rolling-mills, auxiliary machinery and machine shops. These were, we believe, the first rolling-mills driven exclusively by electricity. The present yearly output of the works is about 11,000 tons of pig iron, 18,000 tons of Bessemer and open-hearth ingots, and 15,000 tons of rolled, hammered or pressed material, as finished product. Besides those who work in the woods and the mines the company employs in the works about 500 men.

Description of the Electric Plant.—Electricity is used at Hofors for both lighting and transmission of power. The lighting plant is very simple in character. It consists of a continuous-current three-wire system, which is fed by two generators of 30 HP. capacity each. The generators are both belted to the shaft of a 100 HP. turbine. The voltage is 110 volts on each side. Arc lamps as well as incandescent lamps are used. In the daytime a number of small motors (some 40 HP. together) are also fed from these circuits. While the electric light plant just mentioned has nothing peculiarly interesting about it, the transmission of power system, on the contrary, is of a character which justly has attracted the great interest of electricians as well as of technical people in general. Not only is it a fact that this plant was the first one built for furnishing power for rolling-mills exclusively by electricity, but also these motors were, at the time when the installation was erected, the largest of their type in any part of the world. The generating plant at the primary station is situated at the 100 ft. waterfall which has previously been referred to. There are six turbines in all. Two of the turbines are of quite a special design, each being composed of two wheels, thus making it possible to obtain on the same shaft either 300 HP. at 480 revolutions per minute, or 200 HP. at 320 revolutions per minute. The four remaining turbines have only one wheel each, and are of the following sizes: two giving 300 HP. at 480 revolutions per minute, one for 150 HP. at 515 revolutions per minute, and, finally, one for 40 HP. at 720 revolutions per minute. The well-known three-phase system is used.

The generators are directly connected each to its own turbine. Each of the 300-HP. turbines runs a 300-HP. four-pole three-phase dynamo, working at a voltage of 900 volts (measured from the neutral point to each of the terminals). The field magnets, which are made of cast iron, are stationary, while the armature with laminated core revolves. The armatures have a diameter of 37½ in. and a laminated length of 28½ in. The normal frequency is unusually low, being only 16 complete cycles per second. The energy required for the excitation of the field of each generator is 2,700 watts. The weight of one of these generators is about 19 tons. The 150-HP. turbine is also coupled to a three-phase generator of corresponding capacity, giving 900 volts at a frequency of 60 cycles per second. This generator has 14 poles; otherwise it resembles the larger machines in design, as well as to materials used for its construction. The diameter of the armature is 33½ in. and the length of lamination 21 in. The excitation at full load is 1,500 watts. Two continuous machines, both coupled to the shaft of the 40-HP. turbine, are provided to excite the alternators. These machines also provide the current for lighting the power-house and some private houses. One switchboard made of white marble serves for the whole. Each three-phase generator is equipped with three fuses, one three-pole switch, ammeter, and field rheostat. Three of the large generators are connected each to its own system of overhead conductors supported on wooden poles from the power-house to the works, whereas the fourth serves as a stand-by in case anything should happen to any one of the others. The 150-HP. generator also operates on a line of its own. Each of the exciters can furnish current for the excitation of all the three-phase machines simultaneously.

The line consists of nine copper wires of 9 mm. diameter each and three wires of 5.5 mm., all mounted on the same poles. The length of the line is about 1½ miles. Four motors, each of 200 HP. capacity, are installed for driving the rolling mills—one for the medium train, two for the wire mill, and one for the "fine" train. Each motor is fed from its own generator independently of the others, so that more than three motors cannot run at the same time if loaded to their full capacity. These motors are inductive three phase motors with short-circuited armatures. They have four poles, and run about 460 revolutions per minute. The diameter of the rotors is 35 in., and the length of the lamination 29 in. The starting of the motors is entirely done in the power station. The generator and its motor are, when standing, left connected to the corresponding line. Then the excitation is put on the generator fields, and the gates of the turbine are opened. In this way the generator and motor start about the same time. When started in this way the motors develop their full-load torque when starting without the use of any resistance boxes. Telephones are used between the works and the power station. In addition to these large motors which drive the mills there are also 13 smaller motors of an aggregate capacity of 210 HP. These motors get their current from the 150 HP. generator, the larger motor being fed directly from the line voltage, and the smaller ones by means of transformers. Some of the motors are fitted with short-circuited rotors and others are arranged with complete secondary windings for securing good starting torques. This plant has now been running for about two years, and has given perfect satisfaction.

Messrs. Karl Wallin and Andersson and Ernst Danielson made a report as experts on this plant in July last on behalf of the company to see if the plant fulfilled the conditions in section 2 of the contract. They report briefly as follows: "The power of one of the turbines of the power plant was measured by means of a brake. When carrying out this measurement the armature belonging to the corresponding generator was removed, all the gates of the turbine were fully open, and all the other turbines in the power-house were shut down. A series of observations were made in order to find the power of the turbine at different speeds. Afterwards the brake was removed from the turbine shaft and applied on one of the motors in the works, and at the same time the armature of the generator was put in place and connected to the turbine shaft. On account of these observations it was accordingly only necessary to take readings of the number of the revolutions of the turbine in order to determine the corresponding horse-power. The motor in the works was then run on the brake, and its corresponding power was obtained. As a result of these measurements, and after allowing for the energy which was absorbed in the field magnets of the generator, its rheostat and exciter, we have obtained at normal speed (480 revolutions per minute of the generator, corresponding to a speed of about 456 revolutions per minute of the motor) an efficiency of 75 per cent., and at 520 revolutions per minute of the generator, corresponding to 494 revolutions per minute of the motor, an efficiency of 72 per cent. The corresponding horse-power of the motor was 244 HP. at 456 revolutions per minute, and 216 HP. at 494 revolutions per minute. In conclusion, the experts say that the entire plant is very well laid out, and that, as far as they have been able to ascertain, everything belonging to it is manufactured of the best materials and with the greatest care. They especially praise the ample and solid construction which is a characteristic feature of the whole of the machinery.

* From the *Electrical Engineer*, London.

The Use of Wireless Telegraphy to Avert Collisions at Sea.

M. Edouard Branly, best known in England as the inventor of the so-called coherer, now so generally used in connection with the transmission of electric signals without connecting wires, has contributed an interesting note on the above subject to the Academy of Sciences. In foggy weather it is obvious that there would be a great gain if ships could make their presence known to each other when still some few miles apart. The use of foghorns is not always efficient for this purpose; M. Branly proposes to use electric signals. It is necessary that each ship should be furnished with both transmitters and receivers, and further, that the transmitters on one ship should be able to affect the receivers on others without disturbing its own receiving apparatus. With powerful radiators and sensitive receivers M. Branly states that metallic screens are ineffectual unless the receivers are entirely enclosed. It is, therefore, proposed that an arrangement should be adopted by which a receiver is protected from the influence of the transmitter on board the same ship during the time that the latter is acting, being subsequently exposed to the action of transmitters on other ships. It is stated that it is not necessary to enclose the whole of the receiving circuit, the most sensitive portions alone requiring screening. It is further of importance that the bearing of a neighboring ship, together with its speed and the direction of its motion, should be known. In the first place, a receiver, screened so as to be open to external influences only on one side, might serve to determine the bearing of the ship from which the electric waves are emitted. Further, M. Branly has found that a single spark in a transmitter is capable of affecting a receiver only when the distance between the two is small; to produce effects at greater distances, the number of sparks must be increased. M. Branly has invented certain forms of metallic envelopes for the receiving apparatus which permit of the distance of the transmitter being estimated from the intensity of the action of the receiver.—*Electrical Engineer, London.*

LONDON NOTES.

[From our London Correspondent.]

Municipal Telephone Systems.

It seems that the municipal working of telephone systems in this country is to be an accomplished fact. The Parliamentary Committee recommended competition as a remedy for the evil effects of the existing monopoly and favored municipalization. A license is now granted by the Postmaster General to the Corporation of Glasgow, which has been agitating for it for several years past, but has until now been refused. If the Glasgow Corporation is successful in securing the necessary powers from Parliament, it will equip a telephone system, presumably to compete with the National Telephone Company. This municipal license is only granted until December 31, 1911, when the National Telephone Company's rights also lapse. It is stated that municipal licenses are to be granted to other towns which are applying.

Sunderland Electric Trams.

The Sunderland Corporation recently sent a deputation to the Continent to inquire into electric traction, and the borough engineer reported upon cable traction, the electrical engineer (Mr. J. F. C. Snell) going very exhaustively into the comparative merits, costs, etc., of the trolley, conduit, accumulator and other electrical systems. The report of the deputation brings together a mass of very important descriptive detail and general data, and it has convinced the municipal authority of the benefits of electric traction, for the Corporation has just pledged itself to the equipment of 23 miles of single track. Tenders have not yet been invited for the electrical contracts but they will be very shortly, therefore the following estimate of plant required will possess interest for American manufacturers: The 23 miles of single track has to be laid with 96 lb. girder rails on a concrete bed, and the cost of this, including fishplates, tie rods, etc., is put at £109,150. The bonding of rails will cost £6,900. The line equipment, poles and rosettes, insulators, trolley wire and all apparatus fixed complete is put down at £17,250. Feeder cables will be laid complete in "ducts," with section boxes, manholes, etc., at a cost of £9,200. There will be required 60 single deck motor cars, trolleys, controllers, with two motors and brakes, etc., cost £42,000. Thirty single deck trailers are estimated at £6,600. and the construction of two car sheds will cost £20,000. Five per cent. is put down for contingencies, and as current will be taken from the lighting station a sum is set apart for the provision of the additional traction plant which will be necessary. This will bring the expenditure up to about $1,250,000.

California Power Plants.

The development of electric power for industrial uses is almost phenomenal in California, and this fact is notably illustrated in the case of the two big plants in the vicinity of Redlands. It is stated that it requires 34,560 pounds of coal to operate one-horse power for one year by means of steam. The Redlands plant produces 1,000 horse power in electricity, in addition to the one producing 2,000 horse power. Further, the plant of the Southern California Power Company, producing 4,000 horse power, makes 7,000 horse power in electricity by the two companies in Mill Creek and Santa Ana canons—equivalent, that is, to the consumption of nearly 121,000 tons of coal per year in the making of power by steam. With coal therefore at $4 per ton this means $483,840; dividing this by 300, as the number of working days, gives an average of 403, the equivalent of this number of tons of coal mined per day, and, as the water flow is continuous, these plants are, as it were, inexhaustible mines producing this enormous output.

A Kansas City Editor Lauds the Trolley.

The following is clipped from an editorial in the Kansas City, Mo., *Star*:

"Fifty years hence Kansas City, instead of being a compact mass of masonry, will be built in long strips along the lines of rapid transit. The massing together of buildings in great cities is a result of the lack of quick transportation. Kansas City began to spread out with the advent of the cable car. Its topography was such that the first serious problem was how the town could attain a magnitude beyond the radius of a mule's power to pull a car along a rail. Kansas City owes its impetus toward greatness to the solution of this problem by the cable car. The trolley is a vastly greater appliance. Not only will the trolley refashion Kansas City, but it will have an influence on all the cities of the world. The influence of the trolley on Kansas City will be marked a decade hence and notably in a quarter of a century.

"The signs of the times point to electric transit as the agent for the regeneration of cities, the destroyer of slums and the benefactor of the humble. Progress does not stop for individuals. Lots which are occupied by buildings to-day some years from now will be growing garden truck, and pastures that graze cattle to day will be the valuable corner lots of another generation.

"Kansas City is soon to exchange its cable cars for trolleys. Thus is progress superior to sentiment. There is much to attach Kansas City to its cable lines, for they marked its bound from a border town to a metropolis. The institution of the cable cars signalized the beginning of the boom. And what a boom it was! It was a time when mediocrity rolled in wealth and genius owned the earth. Except for seeing and riding upon those cable cars the people could not have believed the evidence of their senses. The cable was a giant in those days. It harnessed itself to the city and stretched it out miles beyond the wildest dreams of the border days. When the crash came the cables, still traversing the streets from which the throngs had fled, encouraged the people.

"Kansas City continued to hold up its head and claim to possess the finest cable car system in the world. When prosperity returned, the cable car gongs seemed to clang out a note of triumph. Suddenly the trolley car sprang into existence and the cities which still traveled on horse cars while Kansas City rode on cable cars forged ahead with miles of swift electric transit. Kansas City is a devotee of progress and improvement, and much as it cherishes the cable cars it hails the new motive power. The king is dead; long live the king!"

The Eugene Field Monument Fund.

We cheerfully give space to the following note from Mr. A. L. Swift, secretary to the committee having charge of the above fund, and invite attention to the advertisement bearing on the matter which will be found elsewhere in this issue. The object in view appeals strongly to every one who has read Mr. Field's productions in prose or verse:

Editor ELECTRICITY.

DEAR SIR: At a meeting of our committee held Friday, September 23, it was directed that you be notified of the passage of a vote of thanks to the newspaper and periodical press for their generous assistance in this worthy movement. The affairs of the fund are in excellent shape and but a few thousand dollars remain to be raised, when we shall be able to erect a very creditable monument and set aside a liberal fund for the family of the lamented 'Gene Field. The committee has been unable to make any progress at all during the past six months, because of the war, the warm summer months, etc. Owing to the fall sale of books and the holiday subscription to the fund through "Field Flowers," we hope to finish our labors by February 1st. This can only be done by your continued co-operation and help in this final effort for success, which is only made possible by the assistance of a generous press. As you are aware, all the advertising has been donated, and without exception almost by every paper and magazine of note in the country.

Let this last appeal enable us to all join in one final effort for the success of this movement. Without it we will fail.

Please accept the sincerest thanks of our committee and of Mrs. Field. Very sincerely yours,

Chicago, Sept. 28. A. L. SWIFT, Secretary.

LEGAL NOTES.

The suit of Thomas F. Morrin, of Jersey City, against the Edison Electric Illuminating Company of Brooklyn and the Clonbrook Steam Boiler Company, to recover damages for infringement of patent, was decided in favor of the plaintiff in the United States Circuit Court at Brooklyn on the 5th inst. The amount of damages will be settled by a referee.

An injunction restraining Receiver J. L Williams from using any of the assets of the Franklin Electric Light Company of Cape May, N. J., or demanding its books, has been issued by the Court of Chancery. The receiver is permitted to exercise his functions only in carrying out the lighting contract with the city.

The report of Referee Frederick Chormann for the sale of the property of the Buffalo, Kenmore & Tonawanda Electric Railroad, to satisfy the demands of the Fidelity Trust & Guaranty Company, was ratified and confirmed by Justice Childs on the 4th inst.

The Bullock Electric Manufacturing Company of Cincinnati, Ohio, by Attorney C. V. Edwards of New York, has filed a bill in the United States Circuit Court at Baltimore against the Evening News Publishing Company, alleging an infringement of the complainant's patent of an improvement in starting electric motors, and asking an injunction and accounting.

John Jenkins, a real estate dealer in Brooklyn, N. Y., was given a verdict for $400 in the Supreme Court, Brooklyn, on the 4th inst., as damages for having been ejected from a Fulton street car of the Brooklyn Heights Railroad Company. Jenkins in December, 1895, secured a transfer from the Montague street car line of the same company, but allowed several cars to pass, as he could not obtain a seat in them. When he did board a car the conductor refused to accept his transfer, and upon his refusal to pay an additional fare forcibly ejected him. The case at its first trial was dismissed, but the Appellate Court ordered a new trial, Justice Woodward, who wrote the opinion, saying that the plaintiff had a perfect right to wait until he could obtain a seat, without regard to the company's time limit. The second trial resulted in the above verdict. The plaintiff sued for $5,000.

Judge Colt of the U. S. Circuit Court has appointed William P. Clarke of Peabody, Mass., receiver of the Newburyport & Amesbury Street Railway Company on the application of the Mechanics' Savings Bank of Providence, R. I. The railway company failed to pay the September interest on its bonds.

The American Electrical & Maintenance Company of 451 Greenwich street, New York, went into the hands of receivers on the 4th inst., Justice Smyth of the Supreme Court having appointed Aldred K. Warren and Francis Higgins receivers in proceedings brought by the directors for the voluntary dissolution of the corporation on the ground of insolvency. The liabilities are $35,199, nominal assets $29,120, actual assets $17,398, consisting of book accounts, tools, patterns, and materials in process of manufacture. The order to show cause for the dissolution was set down for January 16 before Hamilton Odell, referee. The bond of the receivers was fixed at $30,000. Aldred K. Warren is president of the company, James R. Steers vice-president and Nicholas H. Savey treasurer. The trouble of the company is ascribed to the exhaustion of its cash capital. Several of the large stockholders put up the money to run the concern, and the other stockholders declined to contribute for the continuation of the business. The principal creditors are the Tradesmen's Bank, $6,000; A. H. James, $3,120; A. K. Warren, $2,834; Leon Abbett, $1,840. There are about 180 creditors. The company was organized principally for electrical machinery repair and inspection. The business was started in 1892, and the present company was incorporated in July, 1897, with a capital stock of $250,000.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING.

Bridgeport, Conn.—The debris and machinery in the burned electric light plant at Pleasure Beach are being removed by a corps of laborers. In the spring it is intended to erect another power house, which will occupy an isolated position, and an entertainment feature will be placed where the electric light station was burned down.

Chicago.—A new electric light plant, to cost $200,000, will shortly be added to the Illinois Steel Company's property at South Chicago.

Columbia, Ind.—The council has ordered the purchase of the entire electric lighting plant here owned by private parties. The price is $21,600 and it is to be paid in ten annual payments.

Corbin, Ky.—J. J. Hagan, a leading druggist of this city, has leased the plant of the Corbin Electric Light & Power Company, and is overhauling and improving it in every department.

Crescent City, Fla.—The Pierpont Manufacturing Company has been granted an electric light franchise in this town for twenty years, the town having the privilege of purchasing the plant at the expiration of ten years.

Elizabeth, N. J.—It is reported that a number of our merchants are about to organize a company to set up an independent electric lighting plant, being dissatisfied with the present cost of lights.

Fitchburg, Mass.—The heavy smoke which accumulates in the Hoosac tunnel has destroyed the advantages of the electric light system and the Fitchburg Railroad Company has caused the lights to be removed. However, arrangements for a better system are being considered and unless these fail persons using this route may soon see an electric engine drawings trains through the tunnel.

Florence, Ala. The Florence Milling Company contemplates establishing an electric light plant.

Herkimer, N. Y.—A special election is to be held on October 14 to ascertain the will of the citizens in regard to bonding the town in $13,000 to put in an electric light system.

Litchfield, Ill.—Proposals will be received by the city clerk until the 22d inst. for furnishing electric lights for this city and also for an electric light plant.

Manawa, Wis.—An electric light plant for this place is definitely decided upon; the Little Wolf River Lumber Company will furnish the power.

Newark, N. J.—The People's Light & Power Company has made a new rate for house lighting in the form of a reduction of one tenth of a cent. per hour per lamp, and will make the list prices of commercial and incandescent lighting the same. Heretofore house lighting was listed at a rate equivalent to three-quarters of a cent per sixteen candle power lamp per hour, and commercial lighting was charged for at the rate of sixty-five-one hundredths of a cent. The new rule leaves both classes of lighting at the latter figure, so far as the list prices show.

New York.—The United Electric Light & Power Company has issued the following notice to its customers with reference to the supply of electricity: "All bills for current supplied on and after October 1 will be rendered at the new rates, a schedule of which will be sent you prior to the rendering of October accounts. Your special attention is called to our power service, which owing to the use of Tesla induction motors without commutators and other complicated devices, is vastly superior to any other power service offered. We are giving the matter of the introduction of power apparatus special attention, and are prepared to make our rates for power service especially attractive." The United Electric Light & Power Company owns through the Westinghouse Company the exclusive rights under the Tesla patents within the Borough of Manhattan.

Philadelphia.—The bids for city electric lighting for the year 1899 were opened by Director Riter on the 4th inst. The bidders were the same as last year, but the prices were considerably less. It is estimated that the reduction will be about $30,000. The bids ranged from 29 cents to 39 cents for each light per night according to locality and other conditions. All the companies bidding have their own territory and there is consequently no real competition.

Pratt City, Ala.—P. G. Shook and associates have been granted a franchise here to erect an electric light plant to cost about $10,000.

Whitesboro, N. Y.—A special election is to be held here on the 24th inst. for the purpose of voting on propositions that involve a preference for electric or Welsbach lighting for the village.

Wilkes-Barre, Pa.—The parties who recently purchased and consolidated the gas interests of Wilkes-Barre—Edward C. Jones, a banker of New York, and President Abram Nesbit and Cashier E. W. Mulligan of the Second National Bank of Wilkes-Barre—are said to have also purchased the Wilkes-Barre Electric Light Company.

Uniontown, Pa.—The lighting company of this city has made itself obnoxious to the business men and they propose to establish an electric light plant of their own.

Worcester, N. Y.—The town board have made a contract with John Van Benthuysen to light the village with electric lights, the plant to be in operation by January 1.

STREET RAILWAYS.

Albany, N. Y.—The map and profile of the route of the Albany, Helderberg & Schoharie Electric Railway Company have been filed. Notices will be served at once on property owners through whose property the proposed road will go. If the road is built according to the route filed it will go through the villages of Normansville, Elsmere, Delmar, Slingerlands, New Scotland, New Salem, Clarksville, Helderberg, Indian Ladder, Thompson's Lake, East Berne, Berne, West Berne, Galupville and Schoharie.

Bar Harbor, Me.—The project of building an electric railway from Winter Harbor through Goldsboro and connecting with the Washington County railroad is now under consideration by John G. Moore, J. Montgomery Sears and other well-known capitalists.

Bellows Falls, Vt.—Books have been opened for subscriptions to the stock of the proposed road from this town to Saxton's River. If $20,000 is subscribed the directors will probably increase this amount to $50,000. It is hoped to have cars running by December. The officers of the road are: J. H. Holton, president; A. M. Swain, vice-president; J. J. Flynn, treasurer; Geo. A. Weston, of Bellows Falls, secretary, and Geo. R. Wales, assistant secretary. The directors are: E. C. Kennedy, J. J. Flynn, A. O. Humphrey and J. Holton, all of Burlington; A. M. Swain and Geo. R. Wales of Bellows Falls, and J. F. Alexander of Saxton's River.

Clarksville, Tenn.—Col. J. F. Shelton, in company with a surveyor, has gone over the routes between this city and New Providence and laid out the lines of a proposed suburban electric car line. The length of the proposed line will be about three miles, and if built will connect the largest suburb of Clarksville with the city.

Cripple Creek, Col.—The Colorado Springs & Cripple Creek electric road will probably be built very soon, as some wealthy New York and Baltimore people have become interested in the scheme. The road will start from Colorado Springs and run to Manitou, where it will connect with the Pike's Peak cog road. It will run over the cog road to Windy Point and from that place down into Cripple Creek. Electricity will be used as a motive power on the entire system, as it will supplant the present power on the cog road. Power will be generated at the falls at Lake Moraine where it is believed there will be no trouble in generating 4,200 horse power. It is thought that the line will prove one of the most popular tourist attractions in the world, as few persons who visit Colorado Springs would fail to take a trip over so wonderful a railroad.

El Paso, Tex.—The mule car line here is too antiquated for our people and there is a growing agitation in favor of getting electric cars.

Elizabeth, N. J.—John Kean has secured the right of way for his county trolley road from the township committee of Union. This will enable Mr. Kean to proceed with the construction of his trolley road from Elizabeth to the boundary line of Cranford. This he expects to have completed in about eight weeks.

Fall River, Mass.—An arrangement has been entered into between the Bristol Land & Investment Company and the representatives of a New York electric company relative to the proposed electric road from Providence, R. I., through Warren and Bristol to Mt. Hope, and on this side of the river from Tiverton to Seaconnet Point. The terms of the agreement as understood are that the Investment Company will build the tracks and the New York syndicate will operate the line, furnishing all the cars and promising excellent transportation and frequent trips of the cars. The New York people will also furnish several ferry-boats, bringing them from that city, so that the electric cars can be transported from the dock at Mt. Hope to the Tiverton side.

Greenbush, N. Y.—It is stated that most of the stock in the Greenbush & Nassau Electric Railroad owned by farmers along the route has been purchased at $25 a share by parties who propose to resume the construction of the road.

Hackensack, N. J.—The trolley railway from Leonia to this city which the Bergen County Traction Company is building will be completed in about four months. It will connect with the line running from Fort Lee to Englewood. Ford, Bacon & Davis of New York are the engineers.

Halifax, N. S.—An electric railway scheme of large proportions is under advisement here which if realized will give Nova Scotia the longest line of trolley road in the provinces. It is proposed to build a line from Waverly to Dartmouth and thence to Cow Bay, Lawrencetown, Musquodoboit Harbor and Middle Musquodoboit. The promoters are men of means, with plenty of push, so that there is every possibility that it will materialize if the prospects for the road paying are considered good.

Lansing, Mich.—New York capitalists, accompanied by an engineer, have been inspecting the route of the projected Lansing, Dexter & Ann Arbor Railway with a view to determining if a road built there would be of value to the Detroit & Ann Arbor Railway, in which they are already largely interested. They are said to have been favorably impressed by the examination.

Los Angeles, Cal.—The Huntington syndicate which recently purchased the Los Angeles Railway system are also likely to acquire the Santa Monica line.

Lynchburg, Va.—The street committee of the city council and the Lynchburg Electric Railway & Light Company have agreed on the terms of a contract embodying an extension of franchise and the rehabilitation of the company's road.

Nevada, Mo.—At a special election held in this city recently a proposition submitted by J. B. Quigley to build an electric railway, etc., here was carried almost unanimously. The enterprise Mr. Quigley has in view consists of the railway referred to, also the electric and gas lighting franchise for Nevada, and in addition an electric railway from Nevada to El Dorado Springs, a distance of twenty-three miles, which road will carry both passengers and freight, also the electric lighting franchise for El Dorado Springs. Quigley & Co. have a large part of their material already on hand, and will begin the work of construction at once. It will take an expenditure of $400,000 to build the system.

Newburyport, Mass.—Articles of association of a new street railway corporation, to be known as the Citizens' Electric Street Railway Company, have been published here. The capital stock of the company is $150,000, and it proposes to build and operate an electric street railway in Newburyport, connecting with the town of Amesbury. The directors of the new company are: Charles Goss, of Amesbury; Albert D. Bosson, Chelsea; James F. Shaw, H. I. Bartless, F. L. Atkinson, A. C. Titcomb, Newburyport; W. B. Ferguson, Malden, Mass.

Pine Bluff, Ark.—Col. S. W. Fordyce is interesting himself in the establishment of an electric street railway in Pine Bluff, and will subscribe for $5,000 of the bonds. It is believed that the men holding the franchise will secure aid enough to build the road.

Pittsfield, Mass.—A scheme involving the consolidation of all the electric plants of Southern Berkshire is reported to be approaching consummation. Besides gaining control of these plants a purpose of the promoters is to build an electric railway connecting Pittsfield with Great Barrington. Some of the men whose names are mentioned in connection with the scheme are Daniel Odell and Charles N. Nelson of New York, E. A. Merrill of Minneapolis, and Thomas Greenwood of Great Barrington.

Richmond, Va.—At a public meeting of the citizens of King William a resolution was adopted recommending the issuance of $40,000 of county bonds for the purpose of projecting an electric railway from Richmond through Henrico, Hanover and King William.

Trenton, Mo.—There is a strong movement here in favor of an electric railway connecting this city with Chillicothe, Mo., and meetings are being held to devise means for raising the necessary funds.

Washington, D. C.—The "Star" states that $2,000,000 are to be spent on street railroad construction in the District during the fall and winter, and this by two companies only, the new City & Suburban and the Columbia.

Wheeling, W. Va.—On the 1st inst. a deal was consummated by which the Bellaire, Bridgeport and Martin's Ferry Street Railway Company was absorbed by the Wheeling Railway Company.

Windsor Locks, Conn.—The Springfield & Hartford Construction Company was organized at Warehouse Point on the 28th ult., with a capital stock of $25,000. The company has purchased the charter of the East Windsor trolley railroad which includes about 3½ miles of trolley road between Mt. Tom, Mass., and Wallingford, Conn. The company controls the Springfield & Southwestern Street Railroad and the Suffield & East Granby road.

MANUFACTURING, ETC.

Cleveland, O.—The "Press" says: "The consolidation of the Westinghouse Electrical Company of Pittsburg and the Walker Company of this city will advance the price of electrical goods. S. H. Short, vice-president of the Walker Company, said, Monday: 'Competition between manufacturers has been severe of late, and as a matter of justice to ourselves we will be compelled to advance prices. The Westinghouse Company was formerly our strongest antagonist. I think the combined companies will now be able to control the market.'"

Columbia, Pa.—The Martic Electric Power Company, which has purchased the Susquehanna & Tidewater Canal, running from Wrightsville, York County, to Havre de Grace, Md., is contemplating the introduction of trolley canal boats on the canal, the power to be supplied from its plant in the Susquehanna River, near Wrightsville.

Lancaster, Pa.—H. L. Price of New York has submitted to the Board of Trade a proposition to locate a factory in this city for the manufacture of electrical supplies.

St. Louis.—The capital stock of the Phoenix Carbon Company is soon to be increased from $160,000 to $500,000, for the purpose, it is reported, of meeting the increase of business which is expected to follow settlement of a suit against the National Electric Company of Cleveland, O., in the Federal Court, involving patents that protect the manufacture of goods in which this concern is interested.

Toronto, Can.—The city wants tenders by Wednesday,

November 9, for the supply of a complete electric lighting plant, or for the various portions of the work, viz., engine equipment, counter shaft and pulleys, belting, boilers, feed pump and condensers, water and steam piping, economizers, dynamos and station electrical apparatus, arc lamps, mast arms and lamp attachments, poles and overhead circuits, conduits and cables.

TRANSMISSION PLANTS.

Stockton, Cal.—The Standard Electric Company of California, the company organized by Prince Poniatowski and his associates for the purpose of conducting electricity from the electrical works of the Blue Lakes Water Company in Calaveras County to San Francisco, and for supplying intermediate towns, will immediately apply for a franchise covering the city of Stockton, allowing the company to distribute its power throughout this city. The idea is to furnish electricity for both lights and power. About 1,000 horse-power will be available here at the start. The intention is to continue the line on to San Francisco. Rights of way have been secured from the power works to that city.

Venezuela, S. A.—According to recent advices a French company has secured a concession from the Venezuelan Government to construct an electric railway line 43½ miles in length. The road is to connect Cumana and Cumanacao, and the electrical power is to be generated by the waterfalls of the mountain streams. The company has sent engineers to Cumana to begin the survey.

MINES, ETC.

Aspen, Col.—The electric current supplied from a small power house at the Mollie Gibson mine is used in the operation of an underground railway connecting that mine with the Argentum Juniata mine and furnishes surface and underground lighting for both properties. The saving through the use of electricity at the mines is about $1,000 a month.

COMPANY MATTERS.

Hartford, Conn.—The East Windsor Electric Railway Company has filed a certificate of the acceptance of its charter granted by the General Assembly at the session of 1897.

NOTES FROM A CORRESPONDENT.

Schenectady, N. Y.—Mr. Osmer Slade, a foreman in the armature department of the General Electric Works, was married on Tuesday last to Miss Carr, of this place.

Albion, N. Y.—The Albion Power Company has purchased the local electric light plant. This plant has been in operation for several years. The Power Company now proposes to extend the plant and to operate it by water power secured at Waterport, six miles away. A contract has been let for constructing a dam at Waterport and for putting in the wiring and machinery necessary for the extension of the plant.

PERSONAL AND MISCELLANEA.

Hill Williams, formerly superintendent of the Upper Appomattox Electric Company, Petersburg, Va., died at Milford, Mass., two weeks ago. He had been a sufferer from a brain disorder for a long time.

J. B. Stevens, electrical engineer of the L. I. Fletcher Company of Boston, has assumed charge of the Cumberland Illuminating Company's plant at Great Falls, Maine. Mr. Stevens was formerly in the employ of the General Electric Company as constructing engineer.

Col. Eugene Griffin of the First Regiment U. S. Vol. Engineers is recovering slowly from the fever which caused his return from Porto Rico. He is still confined to his home at Ardsley, Westchester County, N. Y. When fully restored to health, he will rejoin his regiment, which is now engaged in military engineering and construction work in Porto Rico.

On Friday last at Waterville, Conn., R. G. Cleveland, a druggist, was cleaning a desk with the assistance of a clerk, John Turgeon. Each held the bulb of an incandescent electric lamp. Each received a shock which threw him writhing to the floor. Neither could relinquish his hold. Dr. Holroyd, who was in the store, seized Turgeon, and was himself thrown down and badly burned. Finally both men were wrenched from the lamps, but it was several hours before they recovered. Their hands are badly burned, and part of their clothing. The accident was due to the burning out of a controller on a pole near by. There were 1,100 volts in the current. A damp floor assisted in forming the dangerous circuit.

G. M. Esterly, superintendent of the Dawson City Electric Light & Power Company, was in Seattle, Wash., recently, and took passage for the Alaskan city on the steamer Dirigo in which he also shipped about 35 tons of electrical machinery. He stated to a Seattle reporter that arc lights at Dawson City bring $14 a night and incandescents from 50 cents to $1.25, and even at these seemingly enormous prices the supply is far below the demand. The Dawson City Electric Light & Power Company has the following officers: President, William Chappell, formerly of Wisconsin; vice-president, Alexander McDonald, a well-known Klondiker; secretary, Attorney Falcon Joslyn, formerly of Seattle; treasurer, D. Doig, manager of the Bank of British North America at Dawson; manager, J. D. Trenholme of North Dakota; superintendent, G. M. Esterly, for five years general superintendent of the Esterly Twine Binding Harvester Company of Whitewater, Wis. Captain Donald Alson, formerly of Seattle, is electrician of the company at a salary of $15 a day for every day in the year. Samuel Stanley and Thomas Cannon, both Seattle men, are members of the board of directors. The company was incorporated with $75,000 capital stock in August last.

The Philadelphia "Inquirer" relates the following as showing a new use for hairpins. Rather late in the night a trolley car in which there were a number of young women very anxious to get home went bowling along Twelfth street at a good rate, when suddenly there was a flash, a slight report, and the car was in darkness. The fuse had burned out, and the outlook was very good for staying there until the next car came along, forty-five minutes later. The passengers were disgusted. A few of them got up and walked outside to cool off. The conductor was a sort of philosopher, and after making an examination of the fuse resolved on a happy idea. "Now," he confided to one of the passengers, "if I can only get some of those women's hairpins I'll have this fixed up in a jiffy." And with this he went in and explained the case to the female passengers. At first they giggled, but after having their little fun they produced the pins. "You see," said the Knight of the Strap, "I can connect the two poles of the battery with hairpins, which will make the circuit, being good conductors, and it will answer pretty well." In a few seconds he had repaired the break and the car was speeding down the street as if nothing had happened.

COMMERCIAL PARAGRAPHS.

The Electric Appliance Company, Chicago, have just placed in the printer's hands copy for their new telephone catalogue. They claim that this will be the best all-around telephone apparatus and supply catalogue that has so far been issued. It will be ready for distribution in the course of a few weeks, and telephone companies are advised to send in their applications now so that their names may be placed on file and the catalogue may be sent as soon as it comes from the press.

The Goubert Manufacturing Company of New York City, manufacturers of the Goubert Feed-Water Heater, state that they are at present exceedingly busy. The magnitude of modern steam plants is well exemplified by the fact that they have just booked the following orders:

One 8,000 horse-power heater for one of the New York & Pennsylvania Company's pulp mills.

One 3,000 horse-power heater for the Cleveland Railway Company, Cleveland, O.

One 5,000 horse-power auxiliary heater for the Metropolitan Street Railway Company of New York City, making 35,000 horse-power now building for that company alone.

They have also just delivered a 3,000 horse-power heater to the People's Electric Light Company of Newark, N. J.

These orders, in addition to regular calls for heaters of smaller sizes, among them 1,000 horse-power for the Schenectady Railway Company and 1,800 horse-power for the Citizens' Light & Power Company of Houston, Tex., are indicative of the magnitude of the business done by the Goubert Company.

A "Morse Watch" or Secret Telegraph Sounder.

In this issue we introduce our readers to a new telegraph instrument known as the "Morse Watch," which derives its name first from Prof. S. F. B. Morse, the father of electric telegraphy, after whom the American system of telegraphy takes its name "Morse," and second from its strong likeness in its outer form to a pocket timepiece. It consists of a transmitting and receiving telegraph instrument, a key and a sounder, both of which are enclosed in a regular pocket watch case; this type of instrument is known to the telegraph craft under the general title of "secret sounder."

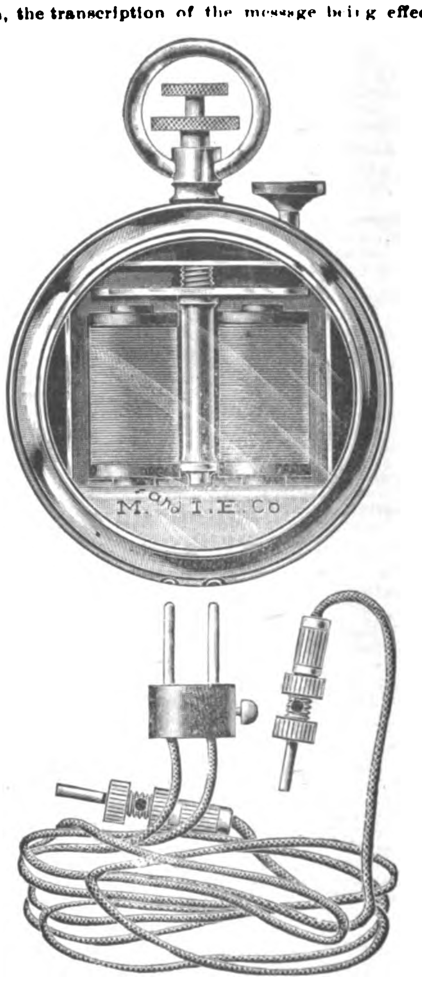
The secret sounder bids fair to play an important part in the telegraph industry of the world. Its precise object is to secure secrecy, portability and immunity from noise.

The Morse Watch is a pioneer instrument in its class. Heretofore some attempts have been made to produce a secret sounder with results more or less satisfactory, but it has remained for the Manufacturers & Inventors' Electric Company of New York to produce the first perfect instrument of the kind, indeed the only one that combines a telegraph key with the sounder. The Morse Watch is so constructed that the click of the instrument can be adjusted loud enough to be heard in any part of a comparatively large room, or be adjusted to a point where the click is inaudible unless the instrument is held in contact with the ear.

The Morse Watch is accompanied with a suitable flexible head band to fasten the instrument in place on the head over the ear, leaving both hands free for transcribing messages or other work. It also has a very neat silk conducting cord with specially designed terminals so that the instrument can be conveniently and quickly attached to or disconnected from the ordinary instrument of a telegraph line.

The employment of the art of telegraphing has so far developed at the present time that the telegraph operator is found in one corner of many brokers' as well as newspaper offices, police stations, etc., and in such places it is desired to maintain for the transaction of other business as much quiet as possible. The Morse Watch secures that end by permitting the telegraphing to go on to all intents and purposes in perfect silence, and as secrecy is often an imperative condition the Morse Watch subscribes to this requirement in the fullest measure by protecting the signals from the hearing of all persons except the operator to whose head the Morse Watch is attached.

Our readers may have often remarked that in later years their telegrams come to them transcribed by typewriters, but it is not generally known that the manipulator of the typewriter and the telegraph operator is one and the same person, the transcription of the message being effected



THE MORSE WATCH.

upon the typewriter simultaneously with its receipt from the telegraph sounder, and owing to the fact that the typewriter is a comparatively noisy machine it becomes necessary for the operator to have an instrument which by being brought close to the ear has an advantage over all other sounds and enables the operator thereby to continue his work uninterruptedly despite any noise or confusion that may surround him, and it is perhaps right here more than anywhere else that the Morse Watch will find its most extended use.

Probably the most important use however that the Morse Watch will serve is in connection with the military telegraphs and all offices where absolute secrecy is one of the first requirements.

Less confidence will not be accorded the practicability of the new invention when it is known that the destinies of the manufacturing concern are presided over by Mr. T. J. Smith, who for so many years was manager of The E. S. Greeley & Co., and is also himself an old-time practical telegraph operator.

Any further information regarding this interesting and useful invention can be secured by addressing the Manufacturers & Inventors' Electric Company, 96 and 98 Fulton street, New York City.

INCORPORATIONS

The Atwood Power & Speed Gage Company, Newark, N. J.—to manufacture electrical and steam measuring instruments. Capital stock, $75,000. Incorporators: George F. Atwood, Orange, N. J.; Harry A. Fields, New York City; George R. Swain, Newark, N. J.

The Portland & Camden Railroad Company, Portland, Ind.—to build and operate an electric railway between

Portland and Camden. Capital stock, $50,000. Incorporators: Frank S. Vine, James Droege and others.

The Metropolitan Electrical Supply Company, Chicago—to manufacture and deal in electrical supplies. Capital stock, $15,000. Incorporators: William H. McKinlock, Walter E. McKinlock and George Dickinson.

ELECTRICAL PATENT RECORD.

Letters Patent Issued October 4, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

611,752. Trolley-Ear. Henry Geisenhoner, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed July 15, 1898.
611,760. Surface-Contact Railway System. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Nov. 29, 1897.
611,778. Electric Railway. Justus B. Entz, Philadelphia, Pa. Filed Dec. 21, 1895.
611,821. Electric-Railway Conduit and Trolley. John H. Robertson, New York City. Filed Oct. 20, 1896.
611,677. Car-Fender. William C. Collyer and William F. Bullock, Lynn, Mass. Filed Dec. 8, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

611,601. Electric-Arc Lamp. Sigmund Bergmann, New York City, assignor to the General Incandescent Arc Light Company of New York. Filed July 10, 1897.
611,766. Device for Suspending Arc-Lamps. Joseph Borka, Buffalo, N. Y. Filed March 4, 1898.

ELECTRICAL MEASURING INSTRUMENTS.

611,722. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Filed Jan. 10, 1898.
611,723. Index Needle or Hand for Electrical Measuring Instruments. Edward Weston, Newark, N. J. Filed Jan. 10, 1898.
611,721. Electrometer. Edward Weston, Newark, N. J. Filed Feb. 14, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

611,719. Electrical Circuit Controller. Nikola Tesla, New York City. Filed Dec. 10, 1897.
611,809 Electric Meter. Sydney Evershed, London, England. Filed Dec. 21, 1897.
611,850 Electromagnetic Engine. Peter B. Watson, Philadelphia, Pa., assignor to Robert M. Robinson, same place. Filed May 9, 1898.
611,869. Automatic Switch Apparatus. Alfred Schlatter, Buda-Pesth, Austria-Hungary. Filed Sept. 21, 1897.
611,902. Apparatus for Adjusting Phases of Alternating Currents. Johannes H. F. Gorges, Berlin, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Dec. 27, 1897.
611,927. Multiple-Rate Metering System. Frederick T. McIntyre, Washington, D. C. Filed March 25, 1898.
611,970. Method of and Means for Controlling Energy Delivered to Translating Devices. Harry W. Leonard, East Orange, N. J. Filed Jan. 21, 1896.
611,996. Apparatus for Cleaning Ships' Plates. Warren P. Freeman, New York City. Filed June 30, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

611,919. Telegraph-Key. Frank E. Lewis, Jefferson, Tex. Filed Dec. 2, 1897.
611,974. Automatic Switching and Telephone System. Lars G. Nilson, Sioux City, Ia. Filed March 9, 1896.

SIGNALS AND SIGNALING APPARATUS.

611,638. Signal Apparatus. Harry G. Leopold, New York City, assignor of one-half to Erwin Lavens, same place. Filed Sept. 8, 1897.
611,894. Signaling. John P. Coleman, Edgewood Park, Pa., assignor to the Union Switch & Signal Company, Swissvale, Pa. Filed Jan. 3, 1898.
611,897. Electric Signal Device for Railways. Louis T. Dube, Paris, France, assignor of one-half to R. N. Archer, Lenoir City, Tenn. Filed Dec. 6, 1897.
611,913. Railway Signaling. Jens G. Schreuder, Edgewood Park, Pa., assignor to the Union Switch & Signal Company, Swissvale, Pa. Filed Jan. 3, 1898.

MISCELLANEOUS.

611,707. Electrical Conductor. Joseph Pedriali, Brussels, Belgium. Filed March 30, 1898.
611,822. Electric Time-Switch. Frederick M. Schmidt, James H. Gerry and William S. Barstow, New York City, assignors to the Self Winding Clock Company, same place. Filed Nov. 18, 1897.
611,971. Electrical Wiremen's Combined Gage and Calculator. Herbert Lutz, Hamilton, Canada. Filed Feb. 28, 1898.
611,992. Alarm-Lock. Edward N. Case, Chicago, Ill. Filed Jan. 8, 1898.

DESIGN.

29,451. Electrical Instrument Case. Waldo A. Layman, St. Louis, Mo. Filed July 14, 1898.

TELEPHONE AND TELEGRAPH.

The Mississippi Valley Telephone Company.

We learn from St. Paul, Minn., papers that a bill of sale was filed in the office of the Register of Deeds in that city on September 30 by which the Mississippi Valley Telephone Company transfers to the J. C. Hubinger Company of Keokuk all of the franchise rights, real and personal property belonging to the telephone company. The sale is in blanket form and covers the franchises, plants and real estate owned by the company in the States of Iowa and Minnesota, including the franchises granted by the cities of St. Paul, Minneapolis, Fort Madison, Burlington and Muscatine, Ia. The consideration does not appear in the bill of sale, this being covered by the words, "for value received."

In January last, J. C. Hubinger, of Keokuk, Ia., applied to the city council of St. Paul for a local telephone franchise. Objection was made, owing to the fact that there had been no incorporation, and the same objection was raised to the granting of a franchise in Minneapolis. To do away with this, Hubinger incorporated under the name of the Mississippi Valley Telephone Company. A number of prominent business men and members of the council in both St. Paul and Minneapolis interested themselves in the proposed new telephone company, and franchises were granted in both cities.

The attorneys and those who appeared in behalf of the company gave it out that J. C. Hubinger, of Keokuk, was the whole thing, as it were, and was perfectly responsible. For fear that there might be a mistake made, the ordinance was drafted with a provision that the new company should not sell or transfer its franchise "to any other telephone company" without the consent of the common council.

The bill of sale is signed by Hubinger as president, and D. R. Craig secretary, of the Mississippi Valley Company. The document is dated at Keokuk, Sept. 17.

Since the ordinance granting the franchise passed the council, considerable work in the construction of the system has been done in St. Paul as well as in Minneapolis.

Conduits have been laid in the business district, and resolutions allowing the company to erect poles and string wires in various parts of the city have been passed by the council.

The fight against the Cumberland Telephone & Telegraph Company has been renewed in the Chancery Court at Memphis, Tenn. The suit was brought by citizens of Memphis and Brownsville to enforce an equal rate of charge for telephones in the State of Tennessee and for damages growing out of alleged illegal discrimination. The rates made by the Cumberland Telephone & Telegraph Company differ widely throughout the State, and the price paid for the use of a telephone for one month in one place, it is alleged, will be sufficient to pay the rent on a similar telephone in another place for a year. In comparing the two towns, Columbia and Brownsville, complainants say that Brownsville has a population of over 3,500 inhabitants and that there is no such difference in the situations of the citizens of Columbia and those of Brownsville as to justify a higher charge in the latter place than the former, and that while 50 cents is charged in Columbia, $1.50 is charged in Brownsville, notwithstanding the obligation imposed upon it by law to furnish all applicants without partiality or discrimination.

In Waterloo, Ia., we learn from a dispatch in the Cedar Rapids *Republican*, trouble has arisen between the city officials and the Cedar Valley Telephone Company, and as a result the company has been ordered to remove its telephones from all the city buildings. The city officials claim that when the company asked for a franchise it agreed that should the request be granted it would furnish all the city telephones free of cost. The franchise was granted, the officials say, but from the first the company has been sending in bills every month and the bills have, after much discussion, been allowed. When the September bill was presented the patience of the council had reached its limit, and a resolution was passed ordering the company to remove its 'phones from all the city buildings.

The San Francisco *Examiner* states that the Pacific Telephone & Telegraph Company has notified the Supervisors of San Francisco that the chief of police is using telephones which infringe upon the Berliner patent possessed by that company, and if their use is persisted in legal steps will be taken to protect the patent rights. At a meeting of the Supervisors' judiciary committee the matter was discussed and referred to the City and County Attorney for his opinion as to the proper action to be taken by the board.

In the Circuit Court at Alexandria, Va., a decree has been entered by Judge Nicol, ordering a sale of the personal property, fixtures, lines, etc., of the Home Telephone Company. John M. Johnson and A. W. Armstrong were appointed commissioners to conduct the sale. The sale was ordered on the application of Douglass Gordon of Baltimore, who holds a large block of the company's stock. The affairs of the company have been in the hands of the courts for some time. In addition to the local service afforded by the Home Company in Alexandria it has operated the Janney line, which connects Alexandria, Fairfax Courthouse, Centerville, Wellington, Manassas, Haymarket and Waverley. The Janney line is in no way affected by the order of the court, and it is said that the sale of the property of the Home Company will be delayed for some time.

The Valley Telephone Company filed at Saginaw, Mich., on the 3d inst. a mortgage covering the issue of $70,000 worth of bonds, issued for the improvement and further construction of the plant. The mortgage runs to Thomas Cranage as trustee. The bonds are dated September 1, and are to be paid in annual installments of $10,000 each, beginning September 1, 1901. They bear 5 per cent. interest and were sold at par.

Capt. Brady of the United States Signal Service has been ordered to begin the construction of an overland telegraph line 320 miles in length from Guantanamo via Santiago de Cuba to Manzanillo. The line is to be used principally for the transmission of Government dispatches, although commercial messages will be accepted. The present cost of transmission of messages by telegraph from Guantanamo to Santiago is 20 cents a word up to thirty words and 12 cents for each additional word.

The Nebraska Telephone Company has a large force of men at work building a line from Seward to Columbus, Neb. This when completed will give that part of the State direct communication with Lincoln. It is the intention, as soon as the line reaches Columbus, to build on west to Grand Island via Genoa and Fullerton, establishing several new telephone exchanges and making Columbus quite a central point.

A telephone decision just rendered by Judge Coolidge of the Circuit Court at Benton Harbor, Mich., will interest all Michigan cities that are in controversy with the Bell Company. The Bell applied for a mandamus to compel the city to grant it permission to set poles and string wires in the streets. The city offered to give a franchise the same as enjoyed by the other telephone company, but the monopoly would not accept it. The court decides that the position of the city is correct.

At Columbus, O., on the 5th inst., the Supreme Court overruled a motion by the Central Union Telephone Company for the dismissal of the suit in mandamus brought by Auditor of State Guilbert against the County Auditor of Franklin county to compel him to list telephone boxes at their true value, rather than at their tangible value, and the case will now be heard on its merits.

A new telephone line is to be established between Smithfield and Suffolk, Va., via Isle of Wight Courthouse. The stock has been subscribed for in Isle of Wight county, and the purpose of the company is stated to be, not to make money, but to build and operate the line from motives of public spirit alone. It will probably be well patronized.

The American Bell Telephone Company's statement of output and return of instruments for the month ended September 20 shows: Gross output, 31,977, increase over the same month in 1897, 12,779; returned, 12,931, increase 5,826; net output, 19,046, increase 6,953. Total outstanding September 20, 1,055,586; increase over 1897, 189,322.

The Southern Bell Telephone Company has just completed the installation of a new switchboard of 1,500 capacity at its exchange in Macon, Ga. It is similar to the one at Atlanta.

Jesse H Walton, a well-known Pennsylvania Railroad telegraph operator, was struck by an engine near Greensburg, Pa., on the 3d inst. and instantly killed. He was 25 years old and married.

Ben A. Neal and Clark Grier have obtained a franchise and will construct a telephone system in Washington, Ga.

New Companies Incorporated.

The Urbana Telephone Company, Urbana, Ohio. Capital stock, $30,000. Incorporators: D. B. McDonald, Edward L. Barber, James S. Bradley, Jr., J. H. Dimond and others.

The Grafton Telephone Company, Grafton, W. Va.—Capital stock authorized, $10,000; subscribed, $900; paid in, $90.

The Seneca Telephone Company, Seneca, Kan.—to maintain and operate a telephone line in Seneca and neighboring places. Capital stock, $5,000. Directors: R. M. Emery, J. H. Glascow, J. T. Campbell, A. R. Spaulding, M. R. Connet and J. H. Hatch, all of Seneca.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed;* inc, income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Oct 10:						
Albany Ry. Co	100	2,000,000	$1,750,000	1½ % Q Aug '98.	151	155
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug, 98	55	67
Traction Co. (Saratoga)	100	50,000	50,000	... ...	.	..
Allentown Pa.—Oct 10:						
Allentown & Lehigh Val. Trac. Co.		1,000,000	1,500,000	....	..	15
Bridgeport, Conn.—Oct 10:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug.. 97	50	..
Baltimore, Md.—Oct 10:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98	65	65½
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S, July 15, '98	23	23⅛
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec, 1897.	...	..
Boston, Mass.—Oct 10:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	...	..
North Shore Traction Co.......com.	100	1,000,000	4,000,000	....	10	11
North Shore Traction Co........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	76	79
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	86	..
b West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S. Oct. 1, '98.	05	106
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	69½	70½
Brooklyn N. Y.—Oct 10:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	63¾	63⅞
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR........guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	214	216
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	236	240
Kings County Elevated	....	4,750,000	4,750,000	....	5	5¾
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad	......	6,000,000	6,000,000	....	..	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Oct 10.						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	65	66
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	79	81
Columbus O.—Oct 10						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Aug., '98.	52	54
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Oct 10:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '98.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Oct 10:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q.	29.	292
Chicago & South Side R. T. RR	100	10,823,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12½	13
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., July, '8.	215	218
hNorth Chicago City RR	100	500,000	249,900	......	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Aug 98	93	93½
jChicago West Div. Ry.......guar.	....	1,250,000	621,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Oct 10:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	117	117¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Oct 10.						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¼ % Jan., '98	39	41
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	69	71
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98	79	80
Detroit, Mich.—Oct 10						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Oct 10:						
City Railway Co.............com.	100	1,500,000	1,470,600	1¼ % Q., Jan. 1, '98.	105	..
City Railway Co..............pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	108

* Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,-970 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Oct 10.						
Hartford Street Ry. Co	100	$4,000,000	$200,000	3 % S., Jan., '98.	140	--
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	..
Holyoke Mass.—Oct 10						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	190	200
Hoboken, N. J.—Oct 10:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	--
Indianapolis, Ind—Oct 10						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	24	25½
Lancaster, Pa.—Oct 10.						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	..
Lancaster & Col. Electric Ry	...	....	87,500.	....	..	..
West End Street Railway	...	....	....	....	..	..
Louisville, Ky.—Oct 10:						
Louisville Ry..................com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	37	38
Louisville Ry.................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	100	100½
Minneapolis Minn—Oct 10:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	27	80
Twin City Rapid Transit....7 % pfd.	..	3,000,000	1,714,200	1¾ %, Jan., '98.	99	101½
Montreal, Canada.—Oct 10						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	272	273
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	102½	103½
Memphis. Tenn.—Oct 10:						
Memphis Street Railway Co	100	500,000	500,000	....	15	--
New Haven, Conn.—Oct 10:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—Oct 10:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	150	..
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	12½	125
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	2½	8
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	9	11
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	13½	32
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	83	85
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23	25½
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	52½	55
New York—Oct 10						
Central Crosstown RR	100	600,000	600,000	2½ % Q	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	60	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98	170	190
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98	163¼	164
eBleecker St. & Fulton Fy.Ry.guar	100	900,000	900,000	¼ % A., July, '98.	84	87
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	218½	225
gCen.Park,N.&E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	180	183
hEighth Avenue RR	100	1,000,000	1,000,000	.. ..	350	855
i42d St. & Grand St. Ferry RR.guar	100	750,000	748,000	4½ % Q.	360	...
jNinth Avenue RR........guar.	100	800,000	800,000	....	180	..
kSixth Avenue RR..........guar	100	2,000,000	2,000,000	....	200	..
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	310	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	178	180
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. '98.	155	160
m42d St., Manhatv'le & St.Nich.Av	100	2,500,000	2,500,000	....	62	..
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	190
Newark N J.—Oct 10						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	50½	51½
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	.
nRapid Transit Street Ry	100	504,000	504,000	11¼ % A.	195	205
Pittsburg, Pa.—Oct 10:						
Allegheny Traction Co	50	500,000	500,000	....	...	..
oConsolidated Traction Co....com	50	15,000,000	15,000,000	2 %, Jan., '95.	21⅛	21¼
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	56¼	56⅛
pCentral Traction Co	50	1,500,000	‖900,000	....	...	...
qCitizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	..
rDuquesne Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '96.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	..
Pgh., Allegheny & Man. Trac. Co	50	8,000,000	‖2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	23½	28⅞
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

* Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds..

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $8,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass- Oct. 10						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass- Oct 10						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.- Oct 10.						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.- Oct. 10:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.- Oct 10						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	69	71
Philadelphia.- Oct 10:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98	67	..
aFairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3 % Feb. 1, '98.	65½	66
Union Traction Co. $12½ pd	50	30,000,000	29,930,450	....	18½	18¾
cElectric Traction Co	50	....	8,297,920	....	71½	71½
Citizens Passenger Ry	50	500,000	†192,500	$3 share Q.	3 7	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	394	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	265	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135	136
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	‖710,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‡20,000,000	$ p. sh., Oct. 98.	89⅞	90
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	170	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	285	300
jPhiladelphia & Darby Ry. guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	2.5	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.- Oct 10:						
Rochester Railway Co	100	5,000,000	5,000,000	....	15	20
Reading, Pa.- Oct 10						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
kCity Passenger Ry	50	350,000	350,000	Jan., '98	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98	65	...
St. Louis Mo.- Oct 10.						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct., '98.	129	130
National Railway Co	..	2,500,000	2,179,000	1¼ %, Oct., '98	..	...
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000		..	..
Citizens' RR	100	2,000,000	1,500,000	1 %, Oct., '93.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % Oct, '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry com.	50	500,000	500,000		57½	59½
Southern Electric Ry 6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	114	116
St. Louis & Suburban Ry	100	2,500,000	2,500,000		52½	53½
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.- Sept.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly	108	109
Geary Street Park & Ocean RR	100	1,000,000	375,000	$2.50 share, '96.	40	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share	54½	55
Presidio & Ferries RR	100	1,000,000	550,000		9	..
Scranton, Pa- Oct 10						
mScranton Railway Co	50	6,000,000	2,500,000	....	12	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.- Oct 10.						
Springfield Consolidated Ry	100	750,000	750,000	....	...	11
Springfield O.- Oct 10:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.- Oct 10:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	195	205
Toronto Canada.- Oct 10:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	102¼	103½
Montreal Street Railway Co		4,000,000	4,000,000	4 % S.	272	273
Washington, D. C.- Oct 10						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	78	78½
Columbia Ry. Co	50	400,000	400,000	6 % A.	75	..
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	..	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	453 900	2½ % Q.	125	126
Worcester, Mass.- Oct 10:						
*Worcester Traction Co.......com.	100	8,000,000	3,000,000	....	15½	16¾
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	95	97¼
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.- Oct 10:						
Wilkesbarre & Wyoming Val. Trac	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co

e Leased to Electric Traction Company.

Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 13 to 1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.- Oct 10						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., July, '98.	280	281
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug '98.	74	75
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	139	..
New York.- Oct 10:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	96	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	109½	110½
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	165	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	74	75
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	110	118
*International Ocean Tel Co. guar 6%	100	8,000,000	......	1½ % Q.	109	112
Mexican Telephone Co	100	2,000,000	......		..	68
*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1½ % Q., July, '98.	150	151
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co. guar. 5 %	25	950,000	559,525	2½ % S.	92	..
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., July, '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	93⅝	93¾
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.- Oct 10:						
American Dist. Teleg. (Phila.)	25	100,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	171	..
Chesapeake & Potomac Telep. Co.	100	......	......	..	50	...
Chicago Telephone Co	100	......	......	......	242	..
Central Dist Prtg & Telg. Co. (Pgh.)	100	750,000	750,000	....	132	134½
Empire & Bay States Telegraph Co.	...	......	......	....	72	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	75	78
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¼ % Q.	112	..
Providence (R. I.) Teleph. Co	50	....	......	..	87	90
Southern New Eng. Teleph. Co	100	3,000,000	...		121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.- Oct 10:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec Series A.	25	......	......	....	...	..
†General Electric Co. [old] com.	100	10,000,000	30,460,000	2 % Q., Aug., 1893.	..	..
General Electric Co. [new] .... "	100	18,276,000	18,276,000	......	78½	79
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2	8
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	..	33	35
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	57½	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.- Oct 10:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,938,000	....	120	..
*Edison Elec Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '98	122½	124
Edison Ore Milling Co	100	...	......	....	11	14
Edison Electric Storage Co	..	......	......		21	23
†General Electric Co. [old] ....com	100	10,000,000	30,460,000	2 % Q., Aug, 1893.		...
General Electric Co [new] ... "	100	18,276,000	18,276,000	......	78½	79
Interior Conduit & Insulation Co.	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.- Oct 10:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	160	..
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.- Oct 10:						
Edison Electric Light Co	100	2,000,000	......	......	144½	
*Electric Storage Battery Co..com	100	8,500,000	......	......	57½	18¼
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	4½	45
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	
*Penna. Ht., Lt. & Pow. Co....pfd.	50	5,000,000	..	6 %, Oct., '97.	.	..
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$32500 dis Jan. 11 '97	13¾	14
Southern Elec. Light & Power Co.	10	187,500	187,500	....	16	..
Miscellaneous.- Oct 10:						
Brush Electric Co	50	..	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co.	25	500,000	......	......	32½	35
Missouri-Edison (St. Louis)....com	..	.....	......	....	11	15
Eddy Electric Mfg. Co	25	.....	......	....	....	15
Hartford (Conn.) Elec. Light Co.	100	350,000	......	....	125	..
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co.	100	100,000	......	....	175	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,00	......	2 % Q., Oct., '98.	84	87
Rhode Island Elec. Protec. Co	100		.....		118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q	153	153¾
Toronto (Canada) Elec. Light Co.	100	1,085,000	1,085,000	1¾ % Q	‡ 133½	1 5
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	....	....		...	95

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,.00 of which $18,.76,00 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

Boston Mass.- Oct 10:						
American Electric Heating Co	50	10,000,000	....	...	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb. 1, '98	..	85
United Electric Securities Co...pfd.	100	......	....	3½ % Feb., '96.	85	87
New York.- Oct 10:						
Consolidated Electric Storage Co.	...	......	....	. ..	18	20
Edison European	..	......	....	. ...	1	5
Safety Car Heating & Lighting Co.	100	......	....	......	101	..
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	80	85
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	97	100
Philadelphia, Pa.- Oct 10:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1	1⅛
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co.....com.	100	3,500,000	......	....	..	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	67½	68
Welsbach Light Co	5	525,100	......	....	42½	48
Welsbach Light Co., Canada	5	500,000	......	....	..	2¼
Pittsburg, Pa.- Oct 10:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co.	100	1,000,000	1,000,000	Q	116	120
Miscellaneous.- Oct 10:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	...	15
*Barney & Smith Car Co ....pfd.	100	......	2,500,000	2 %	...	55
Billings & Spencer Co	25	......	......	....	30	35
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	80	85½
Johns-Pratt Co	100	......	......	....	90	100
*Pratt & Whitney Co...........com	100	......	......	....	4	8
*Pratt & Whitney Co............pfd	100	......	......	....	44	49
Stillwell-Bierce Co...........com.	..	......	......	....	70	80
Stillwell-Bierce Co............pfd.	..	......	......	2 % Sept. 1, '97.	96	98
Shultz Belting Co	100	500,000	......	....	60	80
St. Charles Car Co	–	......	......	...	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Albany, N. Y.						
Date of Quotation—Oct 10, 1898						
The Albany Ry................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112	....
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*118½	....
‡Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co................1st 5s	....	....	......	......	*105½	106
†Interest guar. by Albany Ry. Co.						
‡Principal and interest guar. by Albany Ry. Co.						
Baltimore Md.						
Date of Quotation—Oct 10, 1898						
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115	......
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115	......
Baltimore Trac. Co..Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	105¼	105¾
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116
†Bal. Trac. Co Coll. Trust. 1st mtg. g. 5s	750,000	....	1900	J. & J.	102½	104
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	
Central Pass. Ry. Co..........1st mtg. 6s	96,000	117,000	1912	J. & J.	......	....
†Central Pass. Ry. Co..Cons. mtg. g. 5s	601,000	580,000	1932	M. & N.	117	118
City & Suburban Ry........1st mtg. g. 5s	3,000,000	3,000,000	1922	J. & D.	115	115½
Lake Roland Elev. ....1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	111¾	121
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A.	119½	119½
†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.						
‡$151,000 in escrow to retire 1st. mtg. bds.						
Boston, Mass.						
Date of Quotation—Oct 10, 1898.						
†Lynn & Boston RR.......1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	105
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	106
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....
†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						
Charleston S. C.						
Date of Quotation—Oct 10, 1898.						
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....
†Controlled by Charleston St. Ry. Co.						
Chicago Ill.						
Date of Quotation—Oct 10, 1898.						
Chicago City Ry...........1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¼	102¾
†Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
†Chicago Passenger Ry....Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	......	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	...	....
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	104¼	....
Lake Street Elevated RR...1st mtg. g. 5s.	7,574,000	8,781,200	1928	J. & J.	......	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	53¾	54
North Chicago St. RR........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	...	103
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	...	....
North Chicago City Ry.......consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	106½	107
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	100¾
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	......	95½
‡W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	......
†Redeemable at option on 60 da. notice.						
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.						
¶Subject to call after Oct. 1, 1899, at $110 and interest.						
‖Assumed by W. Chi. RR. Co., lessee.						
‡Int. guar. by W. Chicago St. RR. Co.						
Cincinnati, O.						
Date of Quotation—Oct 10, 1898						
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	103¼	104
*Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & N.	107¼	108
So. Cov. & Cin. St. Ry..........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119	......
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	130	132
†Assumed by the Cincin. St. Ry. Co.						
‖$250,000 reserved to retire 1st mtg. bds.						
Cleveland, O.						
Date of Quotation—Oct 10, 1898.						
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry...Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	103¾	104
Cleveland City Cable Ry.......1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	103	104
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1918	M. & S.	104	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
aEast Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	103	104¼
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	....	....
Lorain (O.) Street Ry..........1st mtg. 6s.	200,000	200,000	1915	J. & J.	....	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....
†$1,900,000 in escrow to retire bonds of absorbed companies, marked a.						
‡Interest guar. by Cons. St. Ry. Co.						
Detroit, Mich.						
Date of Quotation—Oct 10, 1898.						
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	8,885,000	1905	A. & O.	97½	99
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	
The Detroit Ry..............1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105
†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						
New Haven Conn.						
Date of Quotation—Oct 10, 1898.						
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	......
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	......
Winchester Avenue RR...Deben. g. 6	100,000	94,000	1909	M. & S.	103	......

*With interest. *Unlisted.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Orleans La.						
Date of Quotation—Oct 10, 1898.						
Canal & Claiborne RR........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR..........1st mtg. 6s.	......	50,000	1899	M. & N.	101	......
Crescent City RR.........Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	76½	79
New Orleans City RR.........1st mtg. 6s.	416,500	899,000	1903	J. & D.	107	109
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	103⅛	104¼
N. Orleans & Carrollton RR. 2d mtg. 6s.	850,000	850,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	105	110
‡St. Charles St. RR. Co........1st. mtg. 6s.	800,000	75,000	1906	J. & D.	......	....
†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.						
‡$90,000 outstanding.						
New York.						
Date of Quotation—Oct 10, 1898.						
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn)..1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	109	......
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	120½	......
Broadway & 7th Ave..........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	107
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	106	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	113	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	......	......
¶Brooklyn, Bath & W. E. RR. Gen. mtg. 5s.	1,000,000	418,000	1933	J. & J.	90	......
Brooklyn Heights RR.........1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg. 5s.	3,500,000	3,500,000	1941	J. & J.	109½	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	99	100
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	103½	104
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	103	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	112	113
Central Crosstown RR..........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	......
Coney Island & Brooklyn RR. 1st mtg. 5s	800,000	800,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115¾	116½
Dry Dock, E. Bd'y & Bat'y RR..scrip 5%.	1,100,000	1,100,000	1914	F. & A.	101	103
Eighth Av. RR. Co.......Cert. indebt. 6%.	1,000,000	1,000,000	1914	F. & A.	108	......
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115½	117½
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	96	98
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	120	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1,500,000	1997	F. & A.	114	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	109	110
Second Avenue Ry...........Deb. 5s.	300,000	300,000	1909	J. & J.	108½	......
Steinway Ry. (L. I.)........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co..........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	......	......
Twenty-third Street Ry........1st mtg. 6s.	....	....	1909	J. & J.	....	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.......1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A.	113	115
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	112½
†$1,035,000 in escrow to retire gen. mtg. bonds.						
‡$4,850,000 in escrow to retire maturing obligations.						
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.						
§In treasury, $80,000.						
‡‡ Guar. by Union Ry. Co.						
Toronto Canada.						
Date of Quotation—Oct 10 1898.						
Montreal St. Ry.....................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry...........1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....
†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.						
Philadelphia.						
Date of Quotation Oct 10, 1898						
Continental Pass. Ry...........1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry...................1st. mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901		....	....
People's Pass. Ry...............1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry.................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943		102	108
Phila. City Passenger Ry......1st mtg. 5s.	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A.	104	105
Thirteenth & 15th St. Ry.........1st mtg. 7s.	100,000	100,000	1903	A. & O.	....	....
Union Passenger Ry..............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...............Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	.....
West End Passenger Ry..........1st mtg. 7s.	....	......	1905		....	....
West Phila. Pass. Ry........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry..........2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼
§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Pittsburg, Pa.						
Date of Quotation—Oct 10 1898						
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	94½	96
Central Traction Co...........1st mtg. 5s.	875,000	875,000	1930	J. & J	......	......
Citizens' Traction Co..........1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	110	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	......
Millvale, Etna & Sharpsburg.........5s.	750,000	750,000	1923	M. & N.	......	......
Pittsburg, Crafton & Mansfield..........5s.	250,000	250,000	1924	J. & J.	......	......
Pittsburg Traction Co.........1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	......
Pittsburg & Birmingham.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	......	......
Pittsburg & West End........1st mtg. 5s.	500,000	500,000	1922	J. & J.	......	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	......	......
Second Ave. Traction Co...............5s.	2,500,000	2,000,000	1934	J. & D.	......	......
Sub. Rapid Transit Railway Co.........6s.	500,000	500,000	1918	M. & S.	......	......
Providence R. I.						
Date of Quotation - Oct 10, 1898.						
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	..
United Trac. & Elec. Co....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	105	107
St. Louis.						
Date of Quotation—Oct 10, 1898.						
†Baden & St. Louis RR.........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry.......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co........1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1913	J. & J.	111¼	112¼

*With interest.

PASSENGER RAILWAY.

St. Louis.

Date of Quotation— Oct 10. 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co....................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	103
People's RR. Co...................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97⅛	100
People's RR. Co..............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100⅛	101⅛
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101⅛	102⅛
St. Louis & Sub. Ry..............Income 5s.	300,000	800,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	111	112
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	108½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	114⅛	115½

†Controlled by St. Louis RR. Co.
‡Controlled by Union Depot RR. Co.
¶Controlled by Lindell RR. Co.
‖$200,000 in escrow to retire 1st & 2d mtg.
§$600,000 in escrow.
††$200,000 in escrow to retire 1st mtg. bds.

San Francisco Cal.

Date of Quotation— Sept, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	113⅛	115
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	115½	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	91	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	126½	....
†Metropolitan Ry. Co................1st mtg.	200,000	....	......	....	...	......
†Omnibus Cable Co..............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	127¼	128
†Park & Cliff House RR........1st mtg. 6s.	350,000	350,000	1912	J. & J.	104½	105⅛
†Park & Ocean RR................1st mtg. 6s.	250,000	250 000	1914	J. & J.	107	......
†Powell St. Ry.......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	118	120
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......

†Controlled by Market St. Ry. Co.

Washington D. C.

Date of Quotation—Oct 10, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Belt Ry. Co. ....C[illegible] mtg 5s.	500,000	450,000	1920	J. & J.	......	...
Columbia Ry........................ mtg. 6s.	500,000	500,000	1914	A. & O.	120	125
Eckington & Soldiers' Home. mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	121¾	......

†$50,000 in escrow to retire 1st mtg. bds.

Miscellaneous.

Date of Quotation—Oct 10, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	113	115
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	110¼	110¾
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	100	101⅛
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	107⅛	108
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	100	102
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	....	86
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	113	......
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	91⅛	96
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	8,000,000	2,378,000	1928	J. & J.	103	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	...	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	.	......
Paterson (N. J.) Ry.......Cons. mtg g. 6s.	1,250,000	1,000,000	1931	J. & D.	107	108½
Rochester (N. Y.) Ry...........1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	95	100
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½

†$1,000,000 in escrow to retire 1st and 2d mtg. bds.
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.
‖$87,000 in treasury.
§$960,000 res'ved to redeem prior liens.
††$620,000 in escrow.

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.

Date of Quotation—Oct 10, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	103¾	....

Pittsburg, Pa.

Date of Quotation—Oct 10, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Allegheny County Light Co..............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1913	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......

Miscellaneous.—(Oct 10, 1898.)

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	110	115
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117	......
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.

Date of Quotation—Oct 10. 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
American Bell Telephone.....................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co....5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.

Date of Quotation— Oct 10, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
American Electric Heating...........5s.	500,000	500,000	....	....	.15	.19
Farmington & Sims Eng. Co.....................	....	....	......	......	......	25
Barney & Smith Car Co......................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co.......................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co............................	75,000	......	.....	......	....	....

*Unlisted †Nominal

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12@12¼c.; Lake, 12⅜@12½c; casting, 11⅞@12c.

The Quincy Street Railway Company of Quincy, Ill., has filed a mortgage for $500,000 in favor of the Portland Trust Company to secure an issue of bonds for the same amount.

The United Electric Securities Company, Boston, has retired $20,000 of its 5 per cent. collateral trust bonds, 8th series, at an average price of 102.925, leaving $236,000 still outstanding.

The Board of Control of Cleveland, O., adopted a resolution on the 7th inst. that insures a four-cent car fare on two of the principal lines and ultimately on all of the street car lines in Cleveland.

The Kings County Elevated Railroad Company of Brooklyn has ten of its new cars electrically equipped, and in a few weeks will begin carrying passengers across the bridge on electric cars.

Business men of Davenport, Rock Island and Moline, Ia., have purchased a controlling interest in the Tri-City Railway Company at Davenport from its Chicago owners, the purchase price amounting to between $300,000 and $400,000.

The Union Switch & Signal Company, a Westinghouse concern, has absorbed the National Switch & Signal Company of Easton, Pa. The stockholders will meet December 13 to vote on an issue of $500,000 5 per cent. gold bonds to pay for the purchase.

The Southern Electric Light & Power Company of Philadelphia, the only one not owned by the Pennsylvania Manufacturing, Light & Power Company, will on November 23 vote on the question of increasing its capital stock from $400,000 to $2,000,000.

A special meeting of the stockholders of the New York & New Jersey Telephone Company will be held in Brooklyn, N. Y., October 27 to vote upon a proposition to increase the company's capital stock from $5,000,000 to $8,000,000. The proceeds will be applied to extensions and the new stock will be offered to stockholders at par.

The American Railway Electric Light Company has elected the following directors: Alonzo B. Cornell, Edward Valk, Wilbur Huntington, H. Livingston Rogers and H. J. Carr of New York, and Fred J. Haerer, A. N. Chandler, George W. Crosscup and A. G. Fromuth of Philadelphia. The president of the company will be elected this week.

A syndicate of New York capitalists is reported to be negotiating for the purchase of the Sandusky, Milan & Norwalk Electric Railway and the People's City line of Sandusky, O. The transaction is said to be the first step in a plan to build electric railways, connecting a large number of Northern Ohio cities and towns with Cleveland.

Justice Childs has granted to the Commercial National Bank of Cleveland an injunction restraining the Syracuse (N. Y.) Rapid Transit Railway Company from borrowing $23,000. The charge is that certain directors are interested in the deal and that it will cost $30,000 in commissions and $70,000 in preferred stock to perfect the loan. The case will be fought in the courts.

An installment of $5 per share has been called by the directors of the Union Traction Company of Philadelphia, payable on or before November 16 at the transfer office of the company, 423 Walnut street, Philadelphia. Transfer books will close November 15 and reopen November 17. Upon the opening of the transfer books no transfer will be made of any certificate upon which the payment of this installment has not been endorsed.

The directors of the Brooklyn (N. Y.) Elevated Railroad Company have decided to begin proceedings for the discharge of the receiver of the property. The reorganization of the company is now practically accomplished, and the formal sale under foreclosure can be made in about thirty days. A purchasing committee has been appointed which will buy the property in for the security holders, unless some bidder appears who will pay more than $30,000,000 for the same. The name of the reorganized company will be the Brooklyn Union Elevated Railroad Company.

The directors of the Columbia Railway Company, Washington, D. C., have decided to equip that part of their road between the Treasury and 15th street east with the underground trolley. In order to meet the estimated cost of the change of motive power, the acquisition of the right of way for proposed extensions and the cost of construction and equipment of the entire line, which will be a total of about seven miles in length, the stockholders have authorized the issue of $500,000 of 5 per cent. gold bonds, payable in 1914, secured by deed of trust on all the property and franchises of the company.

The New Orleans Traction reorganization plan creates a new company to own all the property of the old company. They will issue $3,000,000 new bonds, $2,500,000 new preferred and $500000 new common, which, together with $3,141,800 undisturbed bonds, makes the total bonded debt of the new company $6,141,800, and annual requirements for taxes and charges $380,013. The stockholders are not pleased with the reorganization scheme, as it seems to promise that small owners of collateral trust notes get an equal amount of new common, but old common holders get only 22½ per cent. of new and have to pay $3 per share assessment.

For the purpose of paying its floating debt incurred in the acquisition of the securities of other street railways, and for changing the motive power of its lines, the directors of the Third Avenue Railroad Company, New York, have decided, it is announced, "to issue stock from time to time instead of issuing bonds. Two millions of stock now in the treasury, and long since authorized to be issued, is now being issued, and further issues will be made in all probability from time to time, as additional money will be required. The amount required for improvements will not be more than $15,000,000, and the total amount of stock issued in any event will not exceed $35,000,000. A consolidation between the present Third Avenue road and some of its affiliated companies is being considered, and if carried out the additional stock will be that of the consolidated company."

The deal by which the Brooklyn Rapid Transit Company was to gain control of the Nassau Electric Railroad in Brooklyn, N. Y., appears to have fallen through. The Brooklyn "Eagle" of the 9th inst., referring to the deal, says: "The Johnsons have fixed par as the price of their common stock. Flynn has refused to sell at 80 for his preferred and common shares. The option to buy the Wilson stock expires on November 3. Up to the present time the Transit people have not purchased it. If they buy it without first getting the stock held by the Johnsons or by Flynn, they can do but little with the property to advance the market value of Rapid Transit, which is, of course, their only object. President Johnson of the Nassau Company is going to Europe next Saturday and does not expect to find any change in the situation when he returns in the next six weeks."

"It is now reported," says the N. Y. "News Bureau," "that the New York Gas and Electric Light, Heat & Power Company, recently incorporated with a capital of $25,000,000, is about to absorb the Block Electric Light & Power Company. The latter is a small corporation with a capital of $200,000, whose operations are confined to a few squares near the Grand Hotel, in the basement of which it has a small plant. The Block Company was chartered in 1894, and its franchise is said to be a very liberal one, unaffected by the twenty-five years limitation, included in the new city charter, limiting the life of corporations. It is understood that the Block Company was purchased last January by former Lieutenant-Governor William F. Sheehan, and that he is interested in the new $25,000,000 company which is to absorb the rights and franchise of the little corporation."

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CONTENTS.

EDITORIAL NOTES.

The People's Telephone Company.

At stated intervals during the past five years the people of New York City have had their hopes buoyed up by announcements of the formation of new telephone companies to compete against the Bell monopoly as represented by the New York Telephone Company. Legislative action having repeatedly failed to bring about a reduction in telephone rates in this city, apparently the only hope for relief lay in the organization of a new concern sufficiently powerful to endanger the interests of the existing company. As just stated, several telephone companies have been started from time to time with this laudable object in view, only to subsequently quietly disappear from the telephone horizon and with them all hopes of relief for the time being at least.

About a year ago there was considerable talk of a new company which it was said was about to be formed to compete with the New York Telephone Company in Greater New York. This company was to be known as the Citizens' Telephone Company, and was said to be an offspring of the company of the same name then successfully operating in Detroit. After attracting considerable attention, as has been usual in such cases, no developments followed, and the general public again relapsed into a state of resignation while awaiting some new appearance in the telephone field in this city. It now seems possible that the patience of the long-suffering telephone users in the metropolis is about to be rewarded. On October 12 there was incorporated at Albany what is known as the People's Telephone Company with a capitalization of $5,000,000.

That the incorporators of this concern are in earnest cannot be doubted, as an organization tax of $6,250 has already been paid, and the fact that a number of wealthy men, among whom are several prominent members of the New York Board of Trade and Transportation, are back of the undertaking, insures, if not its success, at least that a determined effort will be made to gain a foothold in the field that has for years been monopolized exclusively by the New York Telephone Company.

Mr. Frank S. Gardner, secretary of the new company as well as secretary of the Board of Trade, has made the following statement regarding the undertaking:

"The movement is the result of fourteen years of unsuccessful opposition to the telephone monopoly that has New York in its grasp. Costly experience has shown that legislation would never give New York adequate telephone service at reasonable rates. The only way to achieve that end is to give the monopoly battle on its own ground. This the People's Company will do. We will compete in every possible way. The rate we will establish will not be more than one-half the present rate, and probably will be less."

The rates the new company proposes to charge when established will, we understand, be $100 a year for unlimited service in the Borough of Manhattan as against $240 now being asked. Limited service will be offered at the rate of $40 for 400 messages as against $90 for 600 messages now charged. The residence message rate over a private wire will be $30, while unlimited service over party lines will be offered at $12 a year. These figures would seem reasonable, and yet we venture to say they will net the stockholders a fair profit.

The apparently insurmountable difficulties met with by former telephone companies that have endeavored from time to time to gain a foothold in this city have been the procuring of subways wherein to lay cables, and also the procuring of modern central exchange apparatus that would not infringe on some of the numerous patents owned by the Bell Company. It is believed, however, that there are one or two subway franchises owned by more or less obscure concerns that could probably be purchased for a reasonable sum of money, and as the officials of the People's Telephone Company claim they are provided for in this respect, we do not doubt but what the subway difficulty has been overcome. The instruments to be used will we understand be of a new pattern only recently brought out.

Taking it all in all it looks very much at present as though in the near future cheaper rates will be obtained from the New York Telephone Company, not through an act of the Legislature, but in just as forcible a way, through competition.

* * *

A New Submarine Lamp.

An invention has recently been made which should prove of inestimable value to divers in submarine work. Heretofore in examining a wreck or the hull of a vessel under water a comparatively low candle power incandescent lamp enclosed in a heavy and watertight bulb was made use of. Now, however, it has been ascertained that it is practicable to use the arc light for this purpose. That an arc between two carbons can be maintained under water under certain conditions has been known for some time, and is an experiment not unfrequently performed in the laboratory to surprise the uninitiated and apparently demonstrate the fallacy of the old belief that fire and water could never be made to combine. Performing such an experiment and designing an arc lamp to be used many feet under water were two very different things. The problem, however, has apparently been

solved by two students taking the electrical engineering course at Yale—Irving E. Burdick and Francis G. Hall. These young men at the outbreak of the war with Spain were employed by the Government in testing and laying submarine mines in certain harbors along the coast of Maine. While thus employed the advantages of securing a more powerful light for submarine work than the ordinary incandescent lamp could furnish became apparent. After thinking the matter over, a practical method for making use of an arc light suggested itself, and they accordingly communicated with the Navy Department, explaining their idea and asking permission to experiment along that line. Owing to the prosecution of the war their request went for some time unheeded. Permission was, however, finally granted them to go ahead, which they accordingly did, all the experiments being carried on at the New York Navy Yard.

The submarine arc lamp as designed by Messrs. Burdick & Hall after considerable experimenting is an enclosed arc lamp absolutely water tight, with an inner and outer globe, the upper part of the outer globe being hermetically sealed to the metal cylinder containing the feeding mechanism by means of rubber gaskets and rings. The feeding mechanism in this lamp differs from that of the ordinary arc lamp in that it is enclosed in a cylinder both water and air tight. From the top of the cylinder through a carefully packed aperture issue the two insulated wires, which for convenience are bound together into a cable. The lower portion of the lamp is protected by an eight wire guard. Most of the tests made at the Navy Yard were at a depth of twenty-five feet, and at this depth were said to be very satisfactory. Although no attempts have as yet been made to use the lamp below this depth, there would seem little doubt, now that the principal difficulties have been overcome, but what a lamp of this nature could be made to stand any pressure corresponding to any depth at which a diver could safely operate.

The advantages to be derived by the use of a 1,000 or 2,000 candle power lamp where formerly a 32 candle power lamp was made use of are apparent. Owing to the penetrative power of its rays it should enable the taking of fairly good photographs under water, which has heretofore been a more or less difficult matter with the incandescent lamp.

* * *

The Lucigraph. There are at present a number of methods of night signaling in use on the warships of different nations. These systems are in general detail more or less similar, usually consisting of a row of three double lanterns hung from a portion of the ship's rigging or alongside the mast. Each lantern can be made to show either a red or white light, the order in which these lights are lit and extinguished corresponding to a given code. In the merchant marine so far no system of night signaling has been adopted, and even were a merchantman provided with the regulation signaling apparatus used in the navy it would be of no use unless a code were formulated and adopted by vessels of all nations. With a view to overcoming this deficiency, which is said to have been responsible for many shipwrecks and accidents in the past, Mr. John W. Haywood of St. John's, N. F., has invented an apparatus known as the lucigraph, whereby the letters of the international maritime code may be thrown on a suitable background and thus made visible at night. The principle on which the lucigraph works is practically the same as that of the magic lantern, excepting that a far more powerful light is made use of in the former than in the latter. The apparatus is fitted with a four-inch condenser and a two-inch lens. Between the two, on the side, are located a number of movable stencil plates cut to represent the letters of the alphabet and numerals from 1 to 9. Along the top of the apparatus is a keyboard fitted with a double row of keys resembling those on a typewriter. When one of these keys is pressed down the stencil plate corresponding to that key springs up between the condenser and the light, its outline being projected upon any object lying in the path of the light rays. A sheet of canvas tightly stretched has so far been made use of almost exclusively on which to throw the letters, but this background has not proved satisfactory for several reasons. On shipboard, for instance, it has been found almost an impossibility to stretch the sheet sufficiently tight to prevent its being shaken by the wind, resulting in more or less indistinct letters. Another objection raised against this form of background, and which will undoubtedly prevent the adoption of the lucigraph by the navy, is the fact that the showing of a white canvas on a man-of-war in time of hostilities would draw the fire of the enemy, resulting in the almost certain destruction of the background and the interruption of further communication.

With a view to overcoming these defects, the inventor now proposes to make use of two canvas-covered arms, somewhat resembling those of a windmill, which on being revolved at a high rate of speed would show apparently an unbroken surface on which the letters could be thrown. This proposed arrangement, although seemingly an improvement over the canvas sheet, still has objectionable features which would probably cause it to be adopted on shipboard but slowly. The funnels of a ship might be made use of as a background in weather not too heavy, or the reflection might be thrown on the clouds.

The distance at which the letters can be read depends of course upon the intensity of the light used. It is estimated that a 1,000 candle power light will throw a ten-foot letter which can be made out without difficulty at sea a distance of two miles.

In August last the lucigraph was given a trial on the warship San Francisco while off Cape Cod, and although it was generally admitted the apparatus worked all right and was a success, the screen arrangement was condemned for the reason previously given. On the night of October 12 another test of the lucigraph was made at the pier of the North German Lloyd Steamship Company in Hoboken in the presence of a number of steamship companies' representatives. Letters ten feet in height were thrown upon a canvas and were readily made out, in spite of the glare emanating from the city, at a distance of considerably over a mile. So favorably impressed were those present at the results that it is thought that as soon as the background problem has been satisfactorily solved the North German Lloyd line will equip its steamers with this form of night signaling apparatus.

Under the Searchlight.

Notes and Comments on Various Topics.

A FEW nights ago the iron stairway and guard rail leading to the Park avenue tunnel at Thirty-fourth street became charged with electricity from some stray current, resulting in considerable fun for the bystanders. The first person to experience the effect of the current was a Mott street Chinaman. As the Mongolian landed on the top step and grasped the wet railing he gave a yell that echoed down the tunnel, and slid all the way to the bottom, narrowly missing losing his legs under a car which just then shot by. Shaking his fist at the "hidden devil" the Chinaman picked himself up and took the next car. The second victim was a policeman. He took the toboggan with a leap and a jump. A group of people returning from an entertainment were then caught. With a scream men and women went down together. By this time so large a crowd had gathered to watch the fun that the cars were blocked and a policeman had to be called to clear the tracks and prevent further descents until the cause of the disturbance was removed.

* * *

The Westinghouse Company's Last Balance Sheet.

The following appears in the Boston *Herald* of the 11th inst.:

The balance sheet of the Westinghouse Electric & Manufacturing Company as of July 31, 1898, transpires through the listing department of the New York Stock Exchange, and is:

ASSETS.

Cash	$152,732
Bills receivable	115,596
Accounts receivable	2,157,795
Material in stock	1,872,019
Sawyer Man Electric Company	783,253
Real estate, etc	1,519,557
Machinery, tools, etc	1,374,542
Stocks and bonds	5,846,086
Patents, charters, etc	4,763,785
Miscellaneous	354,019
Total assets	$18,951,384

LIABILITIES.

Accounts payable	$559,698
Bills payable	2,741,894
Dividend scrip	194,560
U. S. Electric Light Company bonds	800,000
Collateral Trust bonds	590,000
Preferred stock	3,996,750
Assenting stock	8,227,475
Common stock	146,700
Surplus	2,191,322
Total liabilities	$18,951,384

The item of bills payable is a pretty large one, but cannot be properly valued without more knowledge than is conveyed by a transcript of ledger balances. Some day the company may find it convenient to issue an annual report to the shareholders—some day, when a favor is wanted or there is some end to serve out of the usual order.

* * *

AN amusing incident, says *Electricity*, London, occurred the other day at Leicester. The chairman of the Electric Lighting Committee was just presenting the report of the department for the past half year, and commenting upon the improvement which had taken place, when, for some reason, the room, which was lit with the electric light, was placed in darkness, and gas had to be resorted to.

* * *

IN addition to the immediate consequences of the organization of the People's Telephone Company as affecting the telephone business in New York, its creation must have a beneficial effect as a warning to other mammoth corporations that men and means can always be found to obstruct the aims of those who seek to monopolize trade or take unjust advantage of their opportunities.

* * *

MISS CARRIE PRIEST, the belle of Wintersville, O., a few days ago defeated the intentions of the Phoenix Telephone linemen to place a pole in front of the Priest residence. When the hole was partly dug Miss Priest discovered what they were doing, seized a chair and placed it over the place, sat on the chair and could not be induced to move. The telephone men were compelled to place the hole in another spot.

* * *

THE Paris Exposition commission at Chicago has received a cablegram from Commissioner-General Peck, now in Paris, saying that after extended negotiations the Paris authorities had granted increased concessions of space for American exhibits in the Exposition, amounting in a number of departments to 25 per cent.

* * *

THE rivalry between the Postal Telegraph Company and the Western Union Telegraph Company at Fire Island promises extraordinary results in observatory construction. One has been trying to beat the other on sighting ships first and various devices have been used to accomplish this. The Postal

Telegraph Company has a very high observatory east of the Western Union tower and this gave Observer Young, of the Postal Company, an advantage over Observer Temple, of the Western Union, for the position of the Postal made it possible to see incoming vessels first. The Western Union to overcome this disadvantage is raising its tower thirty-five feet, and when the improvement is completed Observer Temple will be able to catch sight of a steamer as quick if not quicker than his rival. It is reported that the Postal Company will also increase the height of its observatory so that Operator Young will again have the advantage.

* * *

THE St. Louis *Republic* states that rats are playing havoc with the underground cables of the Bell and Kinloch telegraph companies in that city. They have discovered that the wires are covered with paraffined paper, and they rather like the taste. To satisfy their appetites they must gnaw through the lead casing around the wires. It has happened in a number of cases that the rats in gnawing through the lead cables, to get at the greased paper, have bared the copper wires so that they touch each other and cross in such a manner as to make it impossible to establish communication over them. Every time this happens it costs the company whose wires are interrupted all the way from a few dollars to several hundred. The telephone men are trying to devise some means of stopping the depredations.

* * *

A NEW switchboard will shortly be tried by the New York Telephone Company which should do away with many of the inconveniences now experienced, and incidentally make the life of the telephone girl a burden by giving her absolutely no excuse to talk. In the new device the removal of the receiver from its hook lights a tiny electric lamp by the side of the telephone number on the switchboard. When the connection asked for has been made, another lamp is automatically lit which remains lighted until the conversation is ended and the receiver returned to its hook. Thus the "hello girl" will have no excuse to break in on the conversation every few minutes to ask if you are through.

* * *

THE Salt Lake City *News* of the 4th inst. relates the following: "A mile and a half from Hooper station, on the line of the Deseret Telegraph Company, during the electric storm Sunday morning, the lightning played some queer freaks with the telegraph wire, knocking down some thirty-five yards of it, and chopping it literally to pieces. The head lineman, Mr. Carr, of the Deseret Company came to the *News* office last evening with a sack of the wire, which was broken into pieces from a half inch up to several feet in length, most of the pieces being about an inch long. Some of the pieces were found sticking upright in the ground; these were melted at the end that was in the ground, forming a bulk of fused metal. In other instances two pieces of wire had come in contact at the instant of the breaking up, and these were firmly welded together. Another strange fact is that some of the pieces of wire were twisted out of shape, but all were straight as if they had been clipped off by the means of nippers; the ends of all of them, however, were slightly fused. A handful of the wire was taken to Dr. Talmage of the University of Utah and he promptly pronounced it as being one of the strangest freaks of atmospheric electricity he had ever seen."

* * *

THE following, taken from *Industries and Iron*, London, should serve to comfort the residents of the borough of Brooklyn: "Life does not appear to be quite so valuable in Egypt as it is here; at least, they do not set so much value on it as they do in England. During the first week of the running of the Cairo electric cars eighty persons were killed by them, and since then six or seven weekly. The causes are that the Cairenes are mostly deaf or partially blind, and further, that the cars only stop at appointed stations."

Electric Advertising.

An enterprising electrician in Brussels has found the means to combine the attractive with the useful in the way of advertising, and is drawing great crowds nightly in the Place de Brouchère in the heart of the city. He displays advertisements on a screen fixed outside the third-story window of a house on the square. The advertisements are interspersed with cinematograph pictures, and as the waiting public is not provided with a programme, and can, therefore, not tell whether the next picture will be an advertisement or a free entertainment, the former receive more attention than would be the case if they were exhibited by themselves.

A National Credit Association.

The delegates of the various Credit Associations met at the Burnett House in Cincinnati on the 9th inst., and formed the National Credit Association. A constitution and by-laws governing the business policy of the new association were adopted.

The Board of Managers consists of one member of each local society, and it is the purpose of the National Society to issue a monthly list of delinquents and furnish such other important information as may be of interest to its various members. The chairman of the New York Electrical Trades Society, Mr. R. E. Gallaher, informs us that it is the purpose of the organization to establish a credit bureau through which they hope to be able to keep members posted as to all buyers of electrical goods.

THE ACTION OF ELECTRICITY ON PLANTS.*

BY E. H. COOK, D.SC., F.I.C.

The destructive effects of electricity of high potential upon plants needs no demonstration. It is only necessary to remember the wrecks which are made of our finest forest trees by a single flash of lightning to call vividly to mind the enormous power of the discharge. But the action of smaller quantities at lower potentials has not been extensively studied. True it is that from time to time we hear of wonderful results being obtained, and marvelous experiments being made. In many of these cases, undoubtedly, exaggeration has been indulged in, and the attitude of the scientific man has become very much that of the skeptic. This is unfortunate, because there is undoubtedly something in the subject, although the unraveling of the facts is surrounded by peculiar difficulties, involving complicated and extremely prolonged experimentation.

For some considerable time the idea that electricity might have more or less influence on the growth of plants seems to have been simmering in the minds of many experimenters. Thus, in 1806, the great botanist, de Candolle, experimented for a long time, but without arriving at definite results. Other experimenters also tried, but no results seem to have been obtained until Naudin used means for supplying electricity from an external source to the soil in which the plants were growing. He claims to have obtained increased effects. The experiments of Sir William Siemens with the electric light are well known, but some of the most important have been made in Russia by Spechnew, and in France by several agriculturists, of whom, perhaps, M. Barrat and M. Paulin may be mentioned. In these cases the experiments have been made on the large scale, and have extended over many years.

The experiments recorded in this paper were commenced so far back as 1886. They have been repeated many times as the conditions affecting the results gradually became known. They may be considered under three heads: (1) Those relating to the germination of seeds; (2) those relating to the growing of plants in soil; (3) those dealing with the lower forms of plant life such as algæ, fungi, etc.

1. *Influence on the Germination of Seeds.*—Numerous experiments were made in order to see if any effects could be obtained with constant or intermittent currents and with high or low tension electricity. Taking one mode of experimenting as a type of the whole, a current of electricity varying from 1 to 10 milliamperes was passed by means of carbon plates through moistened grains either of barley, wheat, peas, or other seeds contained in beakers. Side by side with these were placed similar seeds through which no current was passed. The current was switched on for about two hours daily. The results were sometimes indefinite, sometimes extraordinarily successful, but the general effect was to give an increased development in the electric seeds amounting to from 10 to 20 per cent. more than in the non-electrified ones.

Experiments were also made with a view of discovering whether constant or intermittent currents were best suited to accelerate the growth. It was found that no advantage could be obtained by constant currents over intermittent ones, and in some cases the constant current was not beneficial.

High-tension electricity was tried by subjecting the seeds to electrification from a Wimshurst machine inside glass vessels before planting. The results obtained showed that in this way a *larger proportion of seeds germinated*, but the electrified show no increased growth over the non-electrified.

2. *Influence on Growing Plants.*—The experiments on seeds showed that with a suitable amount of electricity at a suitable EMF. the germination was accelerated; it then became necessary to determine whether, after the plant was formed, any increase in the rate of the processes of assimilation and absorption took place. For this purpose experiments were tried with seeds planted in similar soil and in similar pots. Through some of these a current was sent between carbon electrodes, while the others were allowed to grow in an ordinary manner. Experiments were tried with intermittent and continuous currents, and with a variety of seeds. In almost every case the electrically urged plants came to maturity first, but they were also the first to show above the soil, and I could not satisfy myself that, with the currents employed, viz., from 1 to 30 milliamperes, and with an EMF. of 5 to 25 volts, any increased rate of growth was observable after the cotyledons appeared above the soil. In other words, an electrically urged plant grown from seed in soil will show above the soil, say, four days before one not so urged; but after that the electrically-urged plant will maintain its four days' start throughout—it will not gain after the first start. Therefore, practically, in growing plants in this way, no advantage is obtained by continuing the application of the electricity after the first appearance of the green leaves. This, of course, applies to electricity of low EMF.

Experiments were now tried to find if the same peculiarity held for electricity of high EMF. For this purpose the discharges from the Wimshurst and from the induction coil were employed. Moreover, the effects of the positive and negative were tried separately. The results showed that with the machine a much increased rate of growth is obtained when the EMF. varies from 25 to 40,000 volts; moreover, that the positive always produced the greater effect *at first*, but that the negative rapidly caught up and took the lead. It was also noticed that with

*Abstract of a paper read before the British Association, Section A.

this kind of electricity certain kinds of plants, such as bulbs, could be accelerated which could not be influenced by the current. In one of these experiments on hyacinths, the color of the blossom produced under the negative was distinctly different from that of the positive, as well as from that of the non-electrified. Possibly this may be caused by the larger amount of ozone produced by the negative discharge.

In order to compare the effects of the battery, the induction coil and the machine, experiments were made with the same seeds grown, (1) without any electricity, (2) with a current passing between carbon electrodes, (3) under the positive point from a Wimshurst machine, (4) under the negative from the same, (5) under the positive point of an induction coil, and (6) under the negative point of an induction coil. *In every case the positive end of the coil produced the greatest effect.* This was with an EMF. of approximately 45,000 volts.

Experiments with Low Forms of Plant Life.—Experiments have been made with yeast, spirogyra and other large-celled fresh-water algæ.

With yeast the rate of development was measured by the rate of evolution of the carbon dioxide. With this substance (yeast), only the current from the battery has been tried as yet. The results were somewhat indefinite, but an increased effect was produced within a very limited range of EMF. and quantity. The complete conditions regulating the growth have not been fully stated, but are still under examination.

The effect upon spirogyra was tried with the current, and with positive and negative spraying from the coil and machine. Microscopic examination was continually made in order to see if any alteration could be observed in the end cell of the filament, and also if the process of conjugation was hastened. No definite conclusions could be reached in reference to either. In some instances it was thought that accelerated growth was produced, but repetition of the experiment failed to confirm the results.

In the case of the current, electrolytic effects took place, gases being evolved from the platinum electrodes.

Great care had to be taken in the spraying with the electricity from the machines, because the fibers of the plants were found to be readily broken up at the junction of the cells, and it was difficult when this occurred to judge of the change in growth of the fibers. It is intended to continue these experiments.

Application on a Large Scale.—Experiments have been made by M. Barrat and M. Spechnew by connecting large plates of copper and zinc sunk in the soil with a wire, and growing plants between, and also by connecting plates to a battery. It is, however, evident that if atmospheric electricity could be employed, a practically unlimited source is available. Beckeinstener was the first to try this. Following him, several experimenters in France and other countries have invented, perfected and used what has been called the "Géomagnétifère," with remarkable results. The instrument is practically a lightning conductor set up in the middle of a field, and connected below with a series of cross wires running under the soil near the roots of the plants.

The results obtained with this instrument are remarkable. Thus, to quote two well-authenticated experiments: A "Geo" was set up in a field adjoining the main road from Montbrison to Montroud, of 8.5 meters high, and made its influence felt over a circular area of 20 meters radius. Within this area were marked out two squares of 4 meters side, and the potatoes growing in these patches were compared with those growing in two equal-sized patches in another portion of the same field. The potatoes grown in the two squares within the area weighed 90 kilos; those grown outside weighed 61 kilos. The number of plants were practically equal. Again, in another case, 60 potato plants grown near the wires of a "Geo" gave 63 kilos, 100 grammes of tubers, whereas 60 plants grown in the same field, but away from the "Geo," gave only 35 kilos. This gives a difference in the money value of about £8 16s. per acre. Both these experiments are well authenticated. In view of these results it was determined to make a trial in Clifton. Accordingly, in the early spring M. Pinot de Moira, who is an excellent amateur gardener as well as a scientist, was induced to put up a "Geo" in his garden on Clifton Hill. Potatoes, beans, tomatoes, peas, etc., were grown near the wires and in other parts of the garden. A distinctly increased effect was observed in all cases near the wire, thus confirming in some measure the results of the French experimenters. The crop of tomatoes is remarkable; on some plants the number of fruits is between 90 and 100, all well developed. For plants growing in the open air this is remarkable. Unfortunately, it was impracticable to grow unelectrified tomato plants to compare with these under similar conditions. It is, however, much to be desired that further and continuous experiments should be carried out.

Theories to Account for the Action.—Before attempting any theorizing, it was thought advisable to thoroughly establish the facts. Much time has, therefore, not been given to the testing of supposed explanations. One of the first ideas would be, that the rise in temperature would, perhaps, cause the effect. Very delicate thermometers plunged in the soil showed no rise in temperature; moreover, it can be calculated that, with the strongest currents employed, the rise in temperature would not exceed $\frac{1}{500}$th of a degree per hour, an amount too small to produce the effects noted.

Another theory which has been proposed by Spechnew is that a process somewhat like electrolysis goes on in the soil whereby the nutrient material is broken up into compounds which are more readily absorbed by the roots of the plants. In support of this, he cites several experiments which he has made. In confirmation in experiments made to test this, I found in the neighborhood of the positive electrode the earth was slightly acid, whereas that near the negative was faintly alkaline, thus proving the existence of an electrolytic action. But obviously this explanation will not account for many of the effects, and, in fact, the subject is so wide that many different actions are probably at work, and it will be necessary to multiply the experiments, and to know more of the conditions, before satisfactory explanations can be given. As a step in this direction, the experiments recorded in this paper are considered to show that a particular plant requires for its maximum development a distinct strength of current and of a definite potential.

THE JUNGFRAU RAILWAY.*

(Concluded from page 213.)

The power-plant at Lauterbrunnen will, when completed, utilize about 1,320 gallons of water per second from the White Lütschine, with a head of 125 ft., of which 115 ft. is utilized at the turbines. The river is swollen in the summer by the melting snow and glaciers from the mountains, and thus at the time when the greatest power is needed the most is available. A steel pipe line about 1,500 yards long serves as a head-race. It taps the river a little below the famous Staubbach waterfall, just above the railway bridge of the Wengern Alp Railway. The pipes have an internal diameter of 5 ft. 11 in. About half of the conduit is nearly horizontal, with a fall of only about 0.3 per cent.; this section of the pipe has a thickness of 0.197 in., and is made in lengths of 19 ft. 8 in. Between this and the lower half of the pipe-line a vertical pipe is attached to avoid shocks and to insure a smooth flow of water. The remainder of the line is of stouter pipe, 0.236 in. and 0.276 in. thick, the internal diameter being the same, and it is made in 24 ft. lengths. The power-house is on the right bank of the river, and the pipe-line has to cross from the left bank over an iron bridge built especially for the purpose. The upper part of the pipe line is buried, the lower part uncovered.

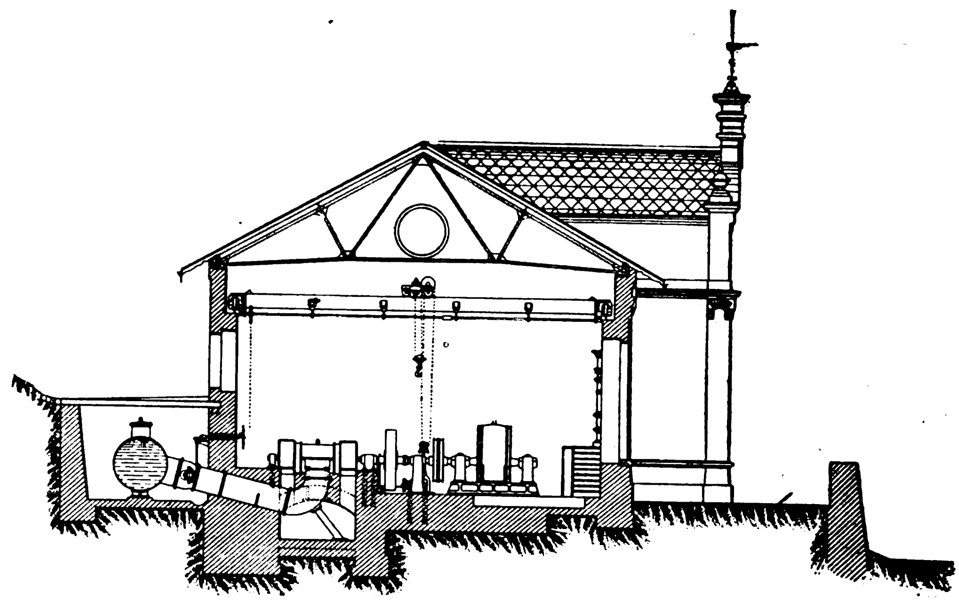


FIG. 8.—SECTIONAL ELEVATION OF POWER HOUSE, JUNGFRAU RAILWAY.

Figs. 8 and 9 show the power-house in sectional elevation and plan. It is proposed to have eventually four generating sets, each of 500 HP. capacity, but only two have been put down to start with. The turbines are of the twin Girard type, with axial flow. They work with 115 ft. head and a flow of 314 gallons of water per second at full load, making 380 revolutions per minute, the speed being controlled by Rieter's automatic governors. The generators, of the Oerlikon inductor type, are directly coupled to them. At the time of our visit the erection of the turbines had been completed, and one of the dynamos was in position, but not yet running. Power for the line and for the work in the tunnel was derived from a 1,000-HP. machine temporarily installed. The switchboard had not yet been completed either, and a temporary one was in use. The generators seem to be built on the lines usually followed by the Oerlikon Co. in their inductor type. As has been already mentioned, three-phase current at 7,000 volts and 38 revolutions per second is generated. The exciters are shunt-wound and four-polar, making 700 revolutions per minute, and generating at full load 150 amperes at 120 volts. Their turbines, which are also directly coupled to them, use 15.6 gallons of water per second. The regula-

* From the *Electrician*, London, Sept. 23.

tion of the voltage is effected by adjusting the resistance in the circuit of the exciter fields. The switchboard is on a gallery from which the whole station can be overlooked. In general appearance the station is well designed, light and roomy. We noticed to our surprise, however, that contrary to English practice, the frames of the machines were insulated from the floor instead of being earthed. This appeared to constitute a not inconsiderable danger to the *personnel*, as the distance between the bed-plates of the machines and their foundations was only about 2 in. or 2½ in. The machine that was running at its full pressure of 7,000 volts was only protected by a wooden balustrade, which it was easy to get over or under; but possibly the arrangements in this respect will be improved when the permanent plant is in running order. As a set-off to this we noticed a paper posted up, containing instructions for the treatment of persons stunned by electric shock.

In concluding this article we wish to express our thanks to Messrs. Brown, Boveri et Cie., and Messrs. J. J. Rieter et Cie. for supplying us with some of the illustrations we have reproduced, and to acknowledge the courtesy shown to our representative by Dr. Wrubel and Herr Gobat, the engineers in charge of the work, and by the other engineers connected with the various sections.

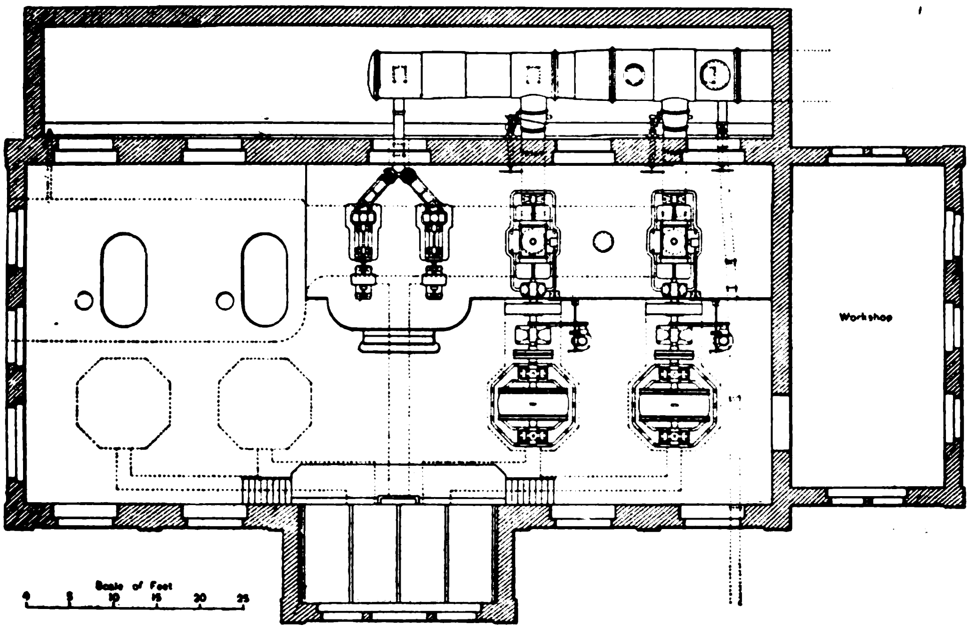


FIG. 9.—PLAN OF POWER HOUSE, JUNGFRAU RAILWAY.

A Large Electrical Pumping Installation.

There has recently been erected, at the collieries of the Arniston Coal Company, in Scotland, what is claimed to be the largest installation of electric pumping machinery in the United Kingdom. Two steam engines, of the horizontal, compound, long-stroke type, drive the dynamos, each being capable of giving 350 IHP. with 120 lb. steam pressure when working condensing. They are fitted with automatic triple expansion gear. Lancashire boilers are used working at a pressure of 140 lb. per square inch. The two continuous-current dynamos are fitted with drum bar armatures and give a total output of 200 kilowatts at 363 amperes and 550 volts. The main switchboard is so designed that the current from one or other of the dynamos, or from both combined, can be used to meet any contingency caused by the breakdown of any part of the machinery. The pumps are of the three-throw type, fitted with rams 11 in. diameter by 18 in. stroke, to deliver 500 gallons per minute against a head of 678 ft. in one case, and against a head of 256 ft., through 3,175 ft. of cast-iron pipe in another. For driving the water against the 678 ft. head, two 80 HP. electric motors are used, their speed being approximately about 450 revolutions per minute. These are coupled together, and are so constructed that the armatures are interchangeable with a single 80 HP. motor, which drives the lower lift pump. There are also three sets of smaller pumps for driving which 25 HP motors are employed.

THE DROP OF POTENTIAL AT THE CARBONS OF THE ELECTRIC ARC.*

BY MRS. AYRTON.

The carbons employed were of the same kind as those used for all my previous experiments on the arc, namely, solid "Apostle" carbons, the positive 11 mm. and the negative 9 mm. in diameter. In order to eliminate errors caused by the difference in hardness or construction of the carbons, only those were used with which it was found the P.D. between the carbons was within half a volt of that given by the equation which I published in 1895 connecting that P.D. with the length of the arc and the current flowing.

To find the fall of potential between each of the carbons and the arc a third carbon was used, varying in diameter between 0.5 mm. and 2 mm. This was brought up to the crater of the positive or the white hot spot on the negative carbon, and the P.D. between it and the main carbon was observed *just before* it touched the main carbon. The P.D. was measured by means of a high-resistance d'Arsonval galvanometer having a resistance of a million and a-half ohms in circuit.

Experiments were made with arcs of 1, 2, 3, 4, 5, 6 and 7 mm., and with currents of 4, 5, 6, 7, 8, 9, 10, 12 and 14 amperes.

The drop of potential at the *positive* carbon I find is affected both by the length of the arc and the value of the current, and the connection between this P.D. in volts, the current in amperes and the length of the arc in millimeters may be expressed by the equation:

$$V = 31.28 + \frac{9+3.1l}{A}. \qquad (1)$$

The drop of potential between the arc and the *negative* carbon, on the other hand, is, I find, affected by the *current* only, and *not* by the length of the arc. The equation expressing its connection with the current is—

$$V = 7.6 + \frac{13.6}{A}. \qquad (2)$$

Thus this drop of potential at the *negative* carbon is by no means insignificant, nor have I ever found its sign to change, either with silent or with hissing arcs, as it is said to do by some observers. In all my experiments this drop of potential has been from arc to carbon, and its value has been about one-fourth of the value of the corresponding fall of potential at the positive carbon.

From equations (1) and (2) we can find the equation for the drop of potential at the positive carbon plus the drop of potential at the negative carbon; i. e., the whole fall of potential from carbon to carbon minus the fall of potential through the arc itself. It is

$$V = 38.88 + \frac{22.6 + 3.1l}{A}. \qquad (3)$$

Now the equation I found three years ago for the *total* P.D. between the main carbons, which included, of course, the drop of P.D. in the arc itself, was

$$V = 38.88 + 2.07l + \frac{11.66 + 10.54l}{A}. \qquad (4)$$

The coincidence between the first terms of equations (3) and (4) shows that this constant quantity has at last been tracked home, and that it belongs *not* to the positive carbon alone, as has hitherto been supposed, but to *both* the positive and negative carbons in the proportion of about four-fifths to the former and one-fifth to the latter.

It must be remembered that the experiments upon which equation (3) is based were made nearly two years after those from which equation (4) was obtained, and that for the new equation (3) itself the experiments consisted of two entirely separate sets, the one made to find the drop of potential at the positive carbon and the other to find the drop of potential at the negative carbon.

As regards the accuracy with which equations (1), (2) and (3) express the results of the experiments, it may be mentioned that each of the 124 values from which these equations for the fall of potential at the carbons alone were formed was the mean of the results of from 6 to 12 experiments. Of these 124 values 96 differed by less than 1 volt from the numbers calculated from the equations, 25 differed by between 1 and 2 volts, and only 3 differed by more than 2 volts, and these three all belonged to equation (1).

This closeness of agreement between the observed and calculated values is the result of no series of ingenious guesses, but of the algebraical expression of three very simple straight line laws which I find exist between the power expended at each of the carbons, the current flowing and the length of the arc. These three laws may be most simply expressed thus:

If W be the power in watts expended at either of the carbons (measured by multiplying the current by the fall of potential at the carbon) and a, b, c, d, e and f be constants, then for the positive carbon

$W = a + bA$ with a constant length of arc,

$W = c + dl$ with a constant current.

For the negative carbon $W = e + fA$.

A combination of the two first laws gives equation (1) and the third gives equation (2).

The method employed for finding the above falls of potential at each of the carbons was not original. It was first used by Lecher ten years ago, and has since been employed by Uppenborn, by Prof. Silvanus Thompson and by many others. These, however, all used a third carbon placed in a stationary position in the arc, while I considered that more accurate results could be obtained by bringing the point of the third carbon up to touch the hottest part of the main carbon, and observing the last P.D. registered by the voltmeter before it fell to zero. Very accurate and definite results were obtained in this way compared with any I could get by the ordinary method, but in interpreting these results it is necessary to take into account the disadvantages under which all experiments made with a bare carbon dipping into the arc labor.

1. The third carbon may not take up the exact potential of the part of the arc in which it is placed.

2. If it does it will bring all the parts of the arc that it touches to practically one potential, which will be greater than the least and less than the greatest of the potentials that existed in that portion of the arc before it was occupied by the exploring carbon.

3. It repels the arc, and therefore makes its real length greater than its apparent length. Hence the

* Abstract of paper read before the British Association, Section A, Bristol, Eng., Sept. 12, 1898.

insertion of the exploring carbon usually increases the P.D. between the main carbons by from one-half to two volts.

As regards the first disadvantage, it is of course possible that there is a contact P.D. between the carbon vapor and the solid exploring carbon, but, even if it exists, this P.D. is probably small compared with the P.D.'s with which we are dealing, and I have therefore neglected it in the calculation of the equations.

The second point appears to be much more important, for it is quite possible that the variable part of the fall of potential at each of the carbons, given by equations (1) and (2), may be mainly produced by the exploring carbon being in communication with the arc, not only at its tip, but also along a part of its length. For whether the fall of potential at the carbon itself be a constant or not, it is certain that the potentials of the other points at which the arc touched the exploring carbon varied both with the current that was flowing and with the length of the arc, before that carbon was inserted. Hence at least a portion of the variation in the values given by equations (1) and (2) must have been created by the use of a bare carbon in the arc, and it is at least *possible* that the whole of those variations were created in the same way.

Many attempts have been made to explore the arc with insulated conductors, notably by Uppenborn, who tried wires embedded in clay, steatite and glass tubes, and had to abandon them all. I myself have tried asbestos coverings for the carbons, but the asbestos melted and fell in drops like metal. Now that the importance of insulating the exploring carbon is so very apparent, however, it will be worth while making a very great effort to find some insulating material that will stand the heat of the arc, and will yet not have to be so thick as to disturb it unduly. This I hope very shortly to do, and thus to completely solve the question of the constancy of the drop of potential at the carbons of the arc.

THE USE OF ELECTRICITY IN THE SPANISH-AMERICAN WAR.*

BY THOS. G. GRIER.

The application of electricity in the Army and Navy for its various and many purposes is recent, but its progress is rapid. The object of this paper is more to note the uses than to describe the details.

The fortification board established ten years ago by the United States Government has developed complete and elaborate plans for the equipment of coast fortifications.

In these plans electricity plays a very important part. Submarine mines connected by cable with harbor forts have been planted, electric light and power stations have been installed, searchlights, motors, telephones, telegraph instruments and many other devices have been used in preparing for the defence of our harbors.

Range finders for determining distances were extensively used; these instruments may be dependent upon electricity for their operation, as in the case of the Fiske range finder, or may be operated mechanically.

Just prior to our recent war with Spain 200 Lewis depression range finders were ordered by the United States Government to equip our various fortifications. While these instruments are operated mechanically, their efficiency in action depends upon the application of electricity in communicating the distance observed to the gun captain or commander.

To condense as much as possible, a brief summary of the applications can be given by describing the methods employed at Fort Wadsworth, which lies just below New York City. In this fort the fire commander directs the attack from a sheltered station equipped with a Lewis range finder. There is also a position-finder station and four battery commander stations. The fire commander is in direct communication with all by means of telephones.

In the position finder's station, together with numerous other instruments, is a dial telegraph, electric clock and telephone. One of the guns is equipped with a dial telegraph and another with a Sheey teleotype, an instrument which indicates the azimuth or angle from a predetermined line and gives the range or distance in yards the observed vessel is from the fort.

All of the commanders' stations are, however, connected with the guns both by speaking tubes and telephones.

Observations are signaled to the guns, and the course and speed of a ship are plotted upon a miniature representation of the harbor. By means of an electric clock placed at every station absolute uniformity of time is obtained, and the probable course and range of a vessel for several minutes can be plotted from these observations, and without even seeing the vessel the gun can be elevated for the range and trained for the proper angle, and by means of a stop watch the order to fire given so that the shot will fall upon the deck of a vessel whose course has been observed by men at a distance from the guns. The introduction of electricity for signaling has given this wonderful control to the fire commander over his batteries.

Sandy Hook, at the mouth of the harbor, is connected by cable with Fort Wadsworth, and the approach of hostile ships may be telegraphed to the fire commander so that their course may be watched and the fort prepared at the proper time to do justice to the work before them.

Sandy Hook was placed in telephone communication also with Washington during the summer, so that the Government was in position to receive or send messages to the fortifications.

Fort Wadsworth has two 60,000 candle-power searchlights to sweep the harbor and guard against the approach of vessels on dark and stormy nights.

An electric light and power plant forms a portion of the outfit, with a reserve storage battery to supplement the power station.

The channel above the fort is mined, and should some of the vessels of a hostile fleet pass the guns of the fort, the observer at the submarine station would be plotting the course of nearby ships by means of range finders or by information furnished them by the fort and at the proper time fire the mine and sink the remnant of the fleet.

The mining of the harbors was an important part of our coast defenses, and the greatest demand for electrical wires and cables was for "torpedo cables" for use in submarine mines. It seems that our coast defense department has for years requested that an appropriation be made for cable, but the appropriations have been so cut down that not more than 5 per cent. of the amount needed was carried on hand by the Government. There are two styles of cables used, a multiple cable of seven conductors which is used to connect the shore end to a junction box in the channel, and a single conductor cable which connects each conductor in the multiple cable to an independent mine, each conductor being numbered. Any mine may be exploded at will from the shore.

When war was declared each of the manufacturers of submarine cable in this country received orders for all they could make in thirty days, and some were kept busy for sixty days, producing probably two hundred miles of multiple cable and two hundred miles of the single conductor. This has been distributed from the Bay of Fundy to Florida. Some was sent to the Gulf cities and some to California, Oregon and Washington. One hundred and fifty miles of each size was under contract in the early part of August. The cost of seven conductor cable averages about $1,900 per mile, and the single conductor about $450 per mile.

SUBMARINE MINES.

There are three different kinds of mines used in our harbor defense.

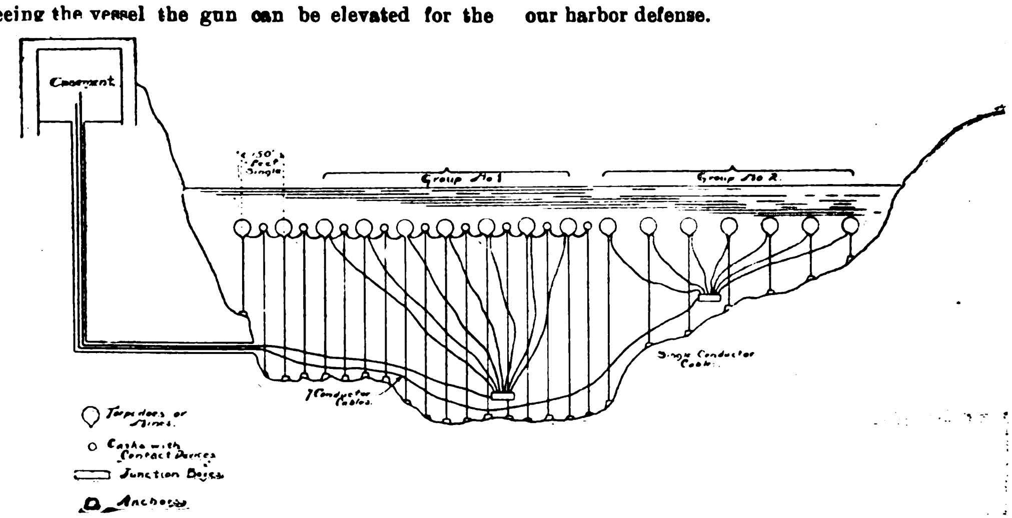


DIAGRAM OF MINES IN BOSTON HARBOR

First—Observation mines, which are fired from shore when a ship is judged by observation to be within effective range of the explosive.

Second—Automatic mines, which are self-firing on being struck by a vessel.

Third—Electrical contact mines, which on being struck by a ship give notice on shore and the operator, by the throw of a switch, fires the mines.

The method of firing observation mines and electrical contact mines are similar. Automatic mines may or may not be fired by electrical means.

Mines may be placed upon the bottom of the harbor, and in such cases are called ground mines, and if they are contact mines the contact mechanism is contained in small buoys anchored at a depth below low-water mark just sufficient for them to be an obstruction in the path of vessels. When the channel is deep, buoyant or floating mines are used. A buoyant mine is more effective, as it lies nearer the object of attack, and for an equal effect does not require as large a charge of explosive.

MINES IN BOSTON HARBOR.

The shape and material of mines or mine cases are various, and the kinds employed at different points not always identical. However, a general description of the mines employed in Boston harbor will give a good idea of the plan and design used in all other harbors.

There were about one thousand mines placed in Boston harbor, covering the main ship channel and ingress to the harbor where vessels of over 12-foot draft could go at low water. The regular Government mine consists of an upright iron cylinder about the shape of a top, with a strap on the bottom for holding the cable. Galvanized steel rope secured by an anchorage of any kind, and in many cases of old horse-car rails, maintained the mines in position.

* Abstract of paper read before Chicago Electrical Association, October 7, 1898.

The cable containing the electric wires runs up separately from the cable holding down the mines.

As the demand was urgent and no mines of the Government pattern were to be had, the engineers in Boston used new ale barrels, a hole being bored in one end for the receipt of the contact mechanism and cable. The barrels were encircled with rope to make a sling to hold them down, a flat steel ring put around the rope so that the steel anchor cable attached to it would not cut through. These mines were of different sizes and held from 100 to 500 pounds of explosive gelatin. Ordinary dynamite was used in some mines where there was not enough gelatin to be obtained. This was put in through a small hole in the top where the electric contact mechanism is placed.

The contact mechanism is connected through high resistance and by a battery circuit, using the cable and ground return for its conductors to an indicating and circuit-closing device located in the protected casement on shore. When a ship strikes a mine containing the device, deflecting the mine from its normal position, the battery circuit is closed; this operates an indicating mechanism which closes a break in the dynamo circuit and notifies the operator. To throw on the current for exploding a mine

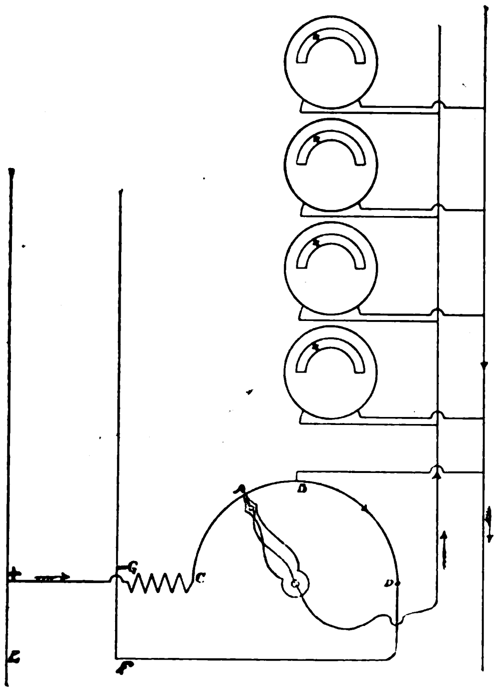


FIG. 1.

it is necessary to throw in a switch or plug after the first break is closed by the indicating device. This circuit can be closed without any contact from the vessel at the will of the officer in the casement.

The firing switchboards at Boston consisted of an ordinary knife switch suitable to take 500 volts, with a spring which holds it out of contact at all times except when kept in position by the operator. These switches, one for every group of mines, were mounted on slate boards and plainly numbered with large letters. A dynamo developing one ampere at 500 volts, driven by an oil engine, furnished the exploding current.

The contact devices were made under the supervision of Dr. Louis Bell, the engineer in charge for the Government. All the parts of the contacting mechanism were of platinum or gold-plated brass to prevent any possibility of corrosion. The exploder consisted of a thin strip of platinum wire which was laid in a case of fulminate, which in turn was put in a case of dry guncotton; the remainder of the explosive was wet.

The mines were usually placed in groups of seven each, about 150 feet apart. These groups of mines in Boston harbor, as shown in the diagram, were strung clear across the channel, and in the main channel there were three lines.

In this method, should a vessel be sunk by the first line of mines and the wreck not obstruct the passage for other vessels, the second line of mines would catch the next vessel and the third line the third vessel. Between the mines were small casks with contacting devices connected to mines on either side. These were cheaper than mines but were equally serviceable and made the line complete, so that no vessel could get through.

The submarine cables connecting the world's cen-

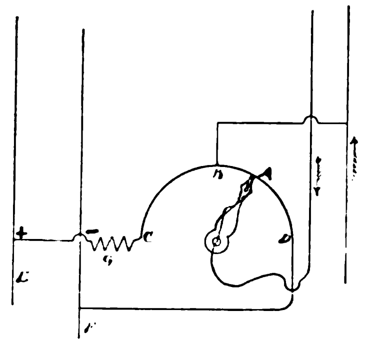


FIG. 2.

ters of humanity—a great system of electric nerves—had a most important influence in every feature of this war. Ships at distant points were enabled to advise and receive information, and movements of fleets could be directed from the seats of government. It is hard to conceive of this almost complete annihilation of time and space.

The Oregon, that speedy and modern man-of-war, equipped with powerful machinery, took eighty-one days to make the remarkable voyage from Puget Sound to Key West, a distance of about 18,000 statute miles, and of this time she was about fifty-nine days at sea. The distance by cable and telegraph from Chicago to Hong Kong is nearly as great, yet to send a message between these two points, including all the delays caused in the many transfers, requires less time in minutes than it took the Oregon days to make the trip.

Our army in the field has its cable tents completely equipped with telephones and telegraph instruments. The telephone at Santiago and adjacent points before and after the siege was of great service, and cable tents now have their names lengthened into the title of cable and telephone tents.

A special cable was furnished the Government, which is used in the signal service by General Greely. It is very light and very strong, weighs about sixty pounds to the mile, and is furnished on reels in half-mile lengths—a two-conductor concentric cable. This outpost cable, as it is called, is carried by a scout on a reel fastened to his back like a knapsack. He carries a telephone, and one end of the cable being connected at headquarters enables him to communicate in whispers to his commander. An attendant accompanies the scout with extra reels, which are easily attached when the wire on the first reel has reached its limit. Telephones, in fact, are used everywhere—in forts, in camps, in the field, and on board vessels.

Among the most recent applications of electricity that found a place in the army and navy was the "X-ray" apparatus. It was used in the field, in the hospitals and on the hospital ships.

Notices were published in the papers of electric cooking outfits, which were going to be placed upon some of the hospital ships, and if it were done there is no doubt that much comfort and convenience resulted, especially when the vessels were in the warm climate of the West Indies.

Aboard modern men-of-war the electric light is found to be absolutely necessary for the efficiency of the ship. Searchlights are used to observe the movements of other vessels, to find buoys or landmarks on entering shallow channels, to pick up disabled boats or men overboard, to make landings and for signaling. The incandescent lamps illuminate the entire ship, dispensing with oil lamps and candles; they are also used for night signaling.

Electric motors are used in hoisting boats and ammunition, for removing ashes, for steering, for training gun turrets and many other purposes.

Steam whistles are opened and closed by electrically operated valves.

The range for guns and the speed and direction of revolving shafts are determined by the electric current, and guns are fired by an electric spark.

Telephones and electric signaling devices aboard ship are extensively used.

This in brief covers the application of electricity ashore and afloat in the recent Spanish-American war.

A description of the principles governing some of the signaling devices on board ship will materially assist in showing to what a great extent modern vessels depend upon electricity.

The signaling and indicating devices used on vessels are: "helm indicators," "steering telegraphers," "speed indicator," "direction indicator," "range indicating system," "Fiske range finder," "azimuth telegraph" and "transmitter of orders." All of the devices consist of galvanometers, which indicate on their dials a difference of pressure, the dials being marked for the different offices the instruments perform, and with each instrument or system of instruments proper devices are used for

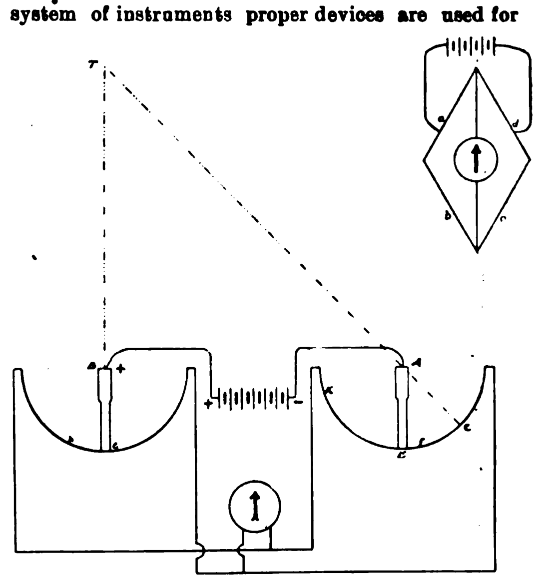


FIG. 3.

altering resistances and consequently changing pressures to accomplish ends in view. A description of the principle applied to the helm indicator will explain the operation in general of all the others.

The object of the helm indicator is to indicate at different parts of the ship the position of the helm. The principle of operation is shown in Fig. 1. Attached to the helm and insulated from it is a metallic contact, A, which presses continually on an arc of resistance wire, C D. At the center of this resistance wire is a permanent contact, B, which is connected by a wire to one side of a number of galvanometers located at various stations. E and F are the negative and positive wires of the electric lighting system. Primary or storage batteries also could be used as the source of energy. A dead resistance is inserted in the circuit connected with the arc of resistance wire, C D, which reduces the current to about two amperes.

The current flows as indicated by the arrows. As the pointer, A, is moved toward the left, or toward C, the difference of pressure A and B becomes greater and the flow of current through the galvanometer is greater. The galvanometers are adjusted so that they take the same angle as the helm, or pointer A. In Fig. 1, when the pointer is on the left of B, its pressure, as compared with B, is positive. When B and A are both in the center, or when the pointer A coincides with the fixed point of contact B, then the needles of the galvanometers come to rest at zero or the center of the scale. When A is moved toward the right or toward D, then the conditions are re-

versed (Fig. 2), A becomes negative compared with B, and the current flows in the opposite direction in the galvanometer, bringing the needle toward the right. One of the instruments can be on the bridge, one in the captain's cabin, one in the wheel house and one in the conning tower.

The steering telegraph is the same arrangement of galvanometers, with a device for altering the resistance by hand. The captain sets the resistance from his station, having an instrument before him. The same indication appears upon an instrument in the wheelhouse, and by noting the helm indicator the captain is advised when his order is obeyed. The same thing is true of the engine telegraph, the transmitter for orders and the azimuth telegraph.

In the Fiske range finder the general principle is the measurement of the resistance of a conductor in the form of a Wheatstone bridge, there being two arcs of wire at the ends of a base line, corresponding to two contiguous members of the bridge. Two telescopes are located at the ends of the base line and carry contacts which move over the resistance wire as the telescopes are turned to be pointed upon any object.

In Fig. 3, let the arms *a*, *b*, of a Wheatstone bridge be represented by arc *h* while *c* and *d* are bent into arc *k*, both of these arcs being wires of conducting material. Let contacts *e* and *s* be attached to telescopes pivoted at A and B. When the telescopes are parallel and when at right angles to the base line, the galvanometer will not deflect and its point of rest is marked infinity. Now let the telescopes converge and the angle of convergence is A T B, and presuming the telescope at B is pointing at right angles to the base line, the angle of convergence is measured by the arc C E. The bridge is out of balance, that is, the needle deflects, and the amount which it is out of balance will vary with the difference of position of the telescopes. The angles of convergence are not indicated upon the galvanometer, or reading instrument, but the deflection of the needle is marked in yards.

The speed indicator is, in reality, a small alternating-current dynamo, the current being great or small according to the speed of the shaft, and the strength of the current indicating upon an alternating-current galvanometer graduated in revolutions per minute. Six soft iron cores or inductors fastened to an iron ring on the shaft form the armature. These are rotated, the pole of a north and south magnet having two coils of wire at its extremities, the coils of wire being connected in series with the galvanometer.

The direction indicator simply tells in which direction the shaft is turning. A permanent magnet fastened to a ring on the shaft revolves in front of a soft iron bar, around which is a coil of wire that is connected to a galvanometer. The shaft revolving in one direction throws the pointer to one side, and when its direction is reversed throws it to the other side.

Enamels.

The use of enamel as the insulator for the resistance wires of electric heating and cooking apparatus is now general, and manufacturers have found out which enamels give the best results. The desiderata are, firstly, that the expansion of the enamels shall be about the same as that of the metals employed, and secondly, that the enamel shall not be very brittle. Mr. Saglio's researches on highly-expansive enamels, contained in his paper to the Société d'Encouragement de l'Industrie Nationale, are of interest in this respect. He found that silica, kaolin, petalite and zircon impart to the enamel infusibility and insolubility, but lessen the expansiveness; that calcic phosphate increases the expansiveness, gives viscosity to the enamel in fusion, and imparts to it a certain insolubility; that cryolite, fluorspar, and above all, rutile (which seems to fix the boracic acid well), increase the expansiveness and the fluidity of the enamel.

ELECTRICAL DISTRIBUTION ON BOARD SHIP.*

BY J. C. BAGOT.

The underlying principles requiring consideration in fitting up vessels with electric light are, generally speaking, outside the experience of the average electrician engaged on land; in fact, the requirements are unique in this department of electric lighting. The methods adopted for distribution on land are generally applicable on board ship, but the system that is chosen, "where practicable," in the majority of cases is the single wire system, in which case the negative pole of the dynamo is placed in contact with the iron of the vessel, which serves for the return circuit. The precautions to be taken are set down in Lloyd's rules affecting electric light on board vessels, but the arrangement of the circuits will depend to a great extent upon the design of the vessel and the places to which the current is required to be carried. The conductors are in almost every case divided into mains, sub-mains and branches. The dynamo should be situated as nearly in the center of the vessel as possible, so that the lights and mains may be divided into two sections, one running forward and the other astern. If the installation be a large one and two dynamos are employed, these two sections may be independently supplied, for by this arrangement an accident in one machine will not affect the working of the other; also reducing the length of the runs of the leads and the loss due to fall of potential, and consequently a reduction in the cross-section of the conductors employed. This is also true if one machine only be employed, providing the divisions are equally balanced beween the two sections. The forward and the astern mains can also be divided into two portions, one running on the port side and the other on the starboard side of the vessel; then the ends of these two branches are joined further on, forming a loop circuit. The following lights are generally what are required on board ship:

1. *Ordinary Lights.*—These lights are placed in such positions where there is plenty of light during the day, such as the cabins, which have large portholes; and the time during which these circuits are in use is usually from 6 P.M. to 11 P.M., at which hour they are switched off from the main switchboard, so that no lights which are liable to be required at irregular hours should be connected to this circuit. The ordinary lights are distributed over four decks generally—namely, the promenade deck, the upper deck, the main deck and the lower deck—with a separately controlled circuit from the dynamo-room.

2. *All-Day Lights.*—These will probably be required on each deck, so that each circuit must be separately controlled. The time during which these lights are required is from 6 A.M. to 11 P.M.

3. *Detective Lights.*—These are used for giving a very feeble light when all other lights are extinguished in the passenger part of the vessel; consequently they must be placed so as to show a continuous light through the length of each deck. These have a circuit of their own.

4. *Cargo Lights.*—The arrangement of these lights will depend upon the position of the hatchway to the holds and the shoots to the coal bunkers. The branches from the mains in these cases will run to terminals instead of lamps, for flexible connections are used in such places, in order to allow the lamps to be lowered in the hole when taking cargo.

5. *Gangway and Passage Lights.*—These are used on the outside of the bulkheads of deckhouses, and are arranged as nearly as possible at equal distances.

6. *Masthead and Side Lights.*—The main circuit for these lights will run to the forward portion of the vessel, only they must in no case be connected with any other circuit, and it should pass through the wheel-house or steering-house, where the switch should also be placed. These lights are fitted with a positive and negative lead complete, irrespective of the system adopted.

7. *Engine-Room and Boiler Space.*—The main circuits for these spaces are nearly always distinct from each other, and the branches are taken from them by means of specially constructed distributing boxes to meet the requirements of the case.

8. *Searchlights.*—The circuits for these on board ship are special; they are directly controlled from the main switchboard, and should always have a positive and negative lead.

The mains are run along the under side of the upper deck, which, of course, is the top of the main deck. The first advantage gained by selecting this position is that the cables are under a watertight cover, and by placing the casing which carries them with grooves downwards no water can lodge in them. Secondly, all the connections of the sub-mains and branches can be made on one deck, which also enables the fuses and switches to be placed near to the joints, with the advantage of being able to control every deck and group of lights from one deck, and there will be less difficulty in tracing any set of wires from its fittings in the event of breakdown.

Before proceeding to put up any casing, the holes through the beams and other ironwork which cross the boat should be drilled. These holes must be large enough to take easily all small cables it is found necessary to carry through, after the holes have been well insulated by a vulcanite or papier maché ring. When the leads are run through watertight iron bulkheads, a special piece of apparatus is necessary where several cables are to be carried through. This consists of a cast-iron trough with holes in the side just large enough for the cable to pass through; then the trough is filled with some insulating compound. But for small cables, and where there is no great number, another method is adopted. After the cable is placed in the proper position, one end of this tube is stopped, and melted insulating compound is poured into the open end. This is done and the compound allowed to set before the tube is placed in the hole.

In respect to the casing, several methods have been tried to render the casing impervious to moisture by the application of insulating substances which will fill up the pores of the wood. The most practical substance has been found to be a wax with a high melting point. The method of applying the wax is to melt it in an iron trough long enough to take the greatest length of casing, which will rarely require to be more than 10 ft. for shipwork. Where the mains or sub-mains have to pass from one deck to another, whether of iron or wood, wrought-iron tubes are employed. These must be galvanized, and stand 6 in. above the deck. When these tubes are fixed, the surplus thread at the bottom is cut away, and the casing is so fitted as to completely cover the nut.

The chief cause of failure to be guarded against is the action of the salt water, which in the form of vapor soon finds its way into every part of the vessel, and causes the greatest damage to the fittings by lodging in places which cannot easily be got at, forming rust on ironwork and rendering woodwork a good conductor, which increases the risks due to leakage, and the insulation resistance is soon found to be below the standard. The water will soon penetrate through the joints in the deck, which, if it has not also an iron deck beneath, will expand and contract by the influence of the water and the sun. This is always the case in a new vessel, and the fact should be remembered in choosing the positions for switches, fuses and other fittings; also the strain to which every part of the vessel is subject when rolling, which opens crevices in bulkheads, straining casings and fittings, and loosening nuts and screws.

In the methods above considered it is assumed ordinary insulated cable is employed, for there are

* From the *Electrical Engineer*, London.

other precautions to be taken, which principally arise from the nature of the cable employed and under what conditions. These conditions will be different in almost every ship. But the most important consideration is the variation of climate through which the vessel passes, so that when selecting the most suitable cable all the above items respecting the insulating material must be considered. When the installation is finished, "and if the separate circuits have been carefully tested during the progress of the work," there will be very little to fear when the current is finally switched on. But, in addition, a final test should be made for insulation resistance. The directions for making such tests are always given with the instruments, but the voltage used in testing must be above the working pressure.

In the above notes the general details and minor considerations affecting all installations are assumed to be well known.

THE JACQUES CARBON BATTERY.

Mr. John W. Langley contributes to the *Journal* of the Franklin Institute for September, 1898, an interesting paper on the above subject, founded on the works of Messrs. H. S. Rosewater and W. H. Oldham, two students in the Case School of Applied Science, Cleveland, O. It will be remembered that Dr. W. H. Jacques, of Boston, recently patented a cell in which electrical energy is obtained directly from the consumption of coal, the efficiency of the process being equal to 32 per cent. instead of the ordinary value of 6 or 8 per cent. In the arrangement used by Dr. Jacques a rod of compressed coal dust, which forms one electrode of the battery, is supported in a vessel containing fused caustic alkali, through which oxygen is blown. The electric energy obtained is ascribed by Dr. Jacques to oxidation of the coal, just as zinc is oxidized in a Daniell cell. On the other hand, Mr. Reed considers the effect to be a purely thermo-electric one. Considering that we might distinguish between these two theories by forcing nitrogen through the cell, it is difficult to see why the subject has not been brought to a definite issue. Reed has passed coal gas through the fused alkali, and found the resulting EMF. equal to that when oxygen was used. Messrs. Rosewater and Oldham used an iron cell, which virtually formed one terminal of the battery, the other terminal being composed in turn of copper, iron and carbon. The pot was then filled with caustic alkali, which was kept fused, whilst a current of air was blown through it.

Curves were obtained showing the relation between the temperature of the pot, the EMF. produced, the amount of air admitted, the nature of the electrode, etc. Mr. Langley concludes that there can be no doubt that the current produced is of thermo-electric origin. In the first place, the general appearance of the curve plotted is characteristic of a thermo electric curve, showing sudden changes in magnitude and direction. Then the maximum voltage occurs when the difference of temperature is greatest. Further, blowing air containing oxygen through the pot ought to increase the potential between the electrodes; this was found not to be the case. The addition of sodium nitrate to the fused alkali was found to reduce the P.D. between the electrodes. The EMF. found by Messrs. Rosewater and Oldham was much smaller than that given by Dr. Jacques. They ascribe this to the smaller size of their pot, together with the very gradual and even heat employed, which tended to lessen the difference of temperature between the electrodes. The subject is, however, by no means settled as yet. There can be little doubt that the passage of an electric current through fused caustic alkali is accompanied by electrolytic decomposition, and it is difficult to imagine the generation of a sufficient pressure by thermo-electric means to effect this decomposition. Anyway, electrolysis must be taken into account, and any theory which neglects this side of the question can hardly hope for ultimate acceptance.—*Elec. Engineer, London.*

CANADIAN NOTES.

The city engineer of Toronto, Ont., has refused to draw up specifications for a 6,000 horse-power municipal power plant as ordered by the city council, and has recommended that $1,000 be appropriated to secure the services of an expert consulting electrical engineer who would draw the specifications.

A United States company which is going to develop the water power of the Jacques Cartier river, in the Province of Quebec, for electric light and power purposes for Quebec City in opposition to the Montmorency Company, has now acquired the chartered rights, as regards the city of Quebec, of the Standard Light & Power Company of Montreal. The American company has a capital of $500,000, and its president is Emerson McMillin of New York.

The Niagara Central Railway has been bought by Haines Bros. of New York. The road will be converted into an electric road, and it is said there will be a 40 minute service between St. Catherines and Niagara Falls. The trestle work at Merritton, Ont., and Thorold will be done away with, and the road run on the ground, the motor cars being able to overcome grades which steam cars could not do. The plans also include the extension of the road.

Although it is only a few years since the first electric railway was built in Canada, it is now possible to obtain in the Dominion all the materials necessary for the complete equipment of an electric road. In the case of the street railway recently completed at St. Thomas, Ont., with the exception of the overhead joists and fixtures, the line was built and equipped with Canadian material, the total cost being $85,000. The rails were made at Hamilton, Ont.; the engines at Amherst, N. S.; dynamos and electrical equipment at Peterboro', Ont., and the cars at Ottawa.

The Engineer Corps in the War.

Brig.-Gen. John M. Wilson, Chief of Engineers, U. S. A., has submitted to Chairman Dodge of the War Investigation Commission his reply to the questions asked by the commission regarding the operations of the Engineer Corps during the war with Spain. Gen. Wilson gives an outline of the work on coast fortifications during the war, the expenditures for which aggregated $4,821,500. Submarine mines to the number of 1,535 were planted in twenty-eight different harbors, together with all their cable, anchors, junction boxes and electrical apparatus. A large number of additional mines with all accessory material were held in readiness to replace mines lost by accident or design, and to extend the mined areas if necessary. In this work were required a large corps of skilled electricians, instrument men, sailors and laborers, in addition to small detachments of engineer troops sent to each locality, with a fleet of tugs, lighters and rowboats for planting the mines, repairing damages and patrolling the mined areas. The expenditures on account of torpedoes for harbor defence to August 1, 1898, amounted to about $1,661,000.

A National Electrical Trades Association.

A national organization of the various electrical trades associations throughout the country was perfected in Cincinnati on the 7th inst. The officers elected are: President, R. E. Gallahar of New York; vice-president, C. M. Wilkins of Philadelphia; secretary and treasurer, Fred P. Vose of Chicago. The board of managers consists of the three officers just named, together with L. R. Keck of Cincinnati, James Wolf of Chicago and W. S. Barker of Boston.

Pennsylvania Street Railway Association.

The seventh annual convention of the Pennsylvania Street Railway Association will be held in Scranton on October 19 and 20.

LEGAL NOTES.

An assignment was made in the County Court at Chicago on the 8th inst. by the Orne Electrical Construction Company, E. Wallace Pease being named as assignee. The assets of the company, consisting of its stock and machinery, are estimated at $5,000. It is thought the liabilities will not exceed the assets. W. N. Wegg is president of the assigning corporation.

The jury returned a verdict for the defense in the suit brought by the La Crosse Department Store Company against the Edison Light & Power Company of La Crosse, Wis. This is the famous "White House" case. The action was brought to recover $60,000 damages. The large store and practically the entire stock of goods were destroyed by fire in December, 1895, and plaintiff claimed that the fire was due to the defective wiring of the defendant company. A year ago the case was tried and the result was a disagreement of the jury. The plaintiff, it is said, will appeal to the Supreme Court on grounds of improper admission of evidence and the judge's charge.

The Denver *News* of the 7th inst. says: "An action to foreclose upon the property of the Colfax Electric Railway Company was commenced in the District Court yesterday morning by George E. Ross-Lewin, trustee for the bondholders. The bill states that $150,000 worth of first mortgage bonds were issued by the road in 1891, and that all the property was conveyed in trust to Joseph H. Thatcher. The latter afterward assigned all his rights in the trust to the plaintiff, Ross-Lewin. It is stated that in December, 1891, the company made default in the payment of its interest and that no payments have been made since then. Ross-Lewin says that he has been instructed by a majority of the bondholders to institute proceedings in foreclosure. The corporation is said to be wholly insolvent, and the financial affairs are in an embarrassed condition."

John G. Gray, 15 years old, obtained a verdict for $10,000 damages for the loss of his left leg against the Metropolitan Street Railway, New York, before Justice Truax of the Supreme Court on the 11th inst. Gray took a Lexington avenue car on January 5 last and rode to Fifty-ninth street, where on a transfer ticket he boarded a crosstown car. He says the latter car was so crowded that he had to get on the front platform, and that when the conductor pushed through to collect the fares he was pushed off and received injuries that necessitated the amputation of his leg.

In the case of Edward Thayer against the Scranton Traction Company, tried at Scranton, Pa., last week, Judge W. W. Porter of the Supreme Court filed an opinion against the plaintiff on the ground of contributory negligence. Thayer was a passenger on one of the defendant's cars, and stood on the back platform when there were vacant seats inside. A collision occurred and the plaintiff was thrown backward, striking the dashboard with his back and falling into the street. He sustained injuries to his back and internally. After discussing the differences between steam cars and street cars, and quoting several decisions covering both, Judge Porter says the trolley car is quite unlike the horse car, and that transportation upon an electric car is quite as perilous as upon steam roads. Continuing, he says: "We reach the conclusion, then, that the platform of an electric car is a place of known danger, and if, while there, a passenger who could have found a seat within is injured, he is guilty of contributory negligence, provided his presence on the platform contributed to the injury he received." It is held that such was the case in this instance, for if the plaintiff had been inside he would not have been injured in the same manner or to the same extent, and possibly not at all. The opinion says it was the duty of the judge below to direct the jury to find for the defendant. Judge Smith filed a dissenting opinion, in which Judge Orlady concurred. Judge Smith holds that the platform of electric cars is not recognized by the public in general as a place of peculiar danger, and that long experience has shown this view to be correct.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING.

Akron, N. Y.—The taxpayers of this village have ratified by a vote of 40 to 8 the proposition to purchase a $3,000 electric light plant for the village.

Atlanta, Ga.—At the election held here on the 6th inst. there was a decisive majority in favor of municipal ownership of the local electric lighting plant. As a consequence the city will immediately take steps, by condemnation proceedings, unless a fair purchase price can be agreed upon with the private owners, to take possession of the plant.

Canandaigua, N. Y.—M. D. Munger, of this town, has asked the board of trustees for a franchise to establish an electric light plant in Canandaigua. Mr. Munger was formerly president of the local street railway.

Elk Rapids, Mich.—A company to be known as the Elk Rapids Electric Light Company will probably be organized shortly, as steps are being taken in that direction by leading business men. There is a strong demand for electric lights.

Florence, Ala.—F. M. Perry, a large landholder and capitalist, is erecting a flouring mill and cotton gin on Cypress Creek, just outside of the city, and proposes to erect an electric light plant to be run by the same water power if he secures a contract for street lighting from the city.

Fredericksburg, Va.—The committee on light of the council has made arrangements to get power to operate the new electric light plant to be built by the city from the water power in this vicinity owned by Mrs. Martha E. Clarke.

Grand Rapids, Mich.—The electric lighting contract awarded by the council to the Chase Construction Company of Detroit is held up in the council, as it failed when presented for final action to get the requisite vote.

Hallstead, Pa.—A contract for lighting the village has been made with a private company by the borough council, and the electric plant will be erected at once. The Delaware, Lackawanna & Western Railroad Company will place 14 arc lights in their yard here, and several citizens have agreed to take the light for their houses and business places.

Horton, Kan.—An electric company of Cleveland, O., has been granted the right to construct and maintain an electric light plant in this city.

Marshfield, Wis.—The bid of the Marshfield Water, Electric Light & Power Company for lighting the city was rejected by the council as being too high, and the mayor has appointed a committee to investigate and ascertain the probable cost of maintaining and operating a plant to be owned by the city.

Marcus Hook, Pa.—Walter G. Rust has been granted a franchise for an electric light plant in this borough, with these conditions: that the poles and wires he erects do not interfere with other wires and poles in the borough; that the poles are straight and neatly painted; that at any time Mr. Rust stops running the plant the wires and poles are to be removed; that the borough shall have the use of the poles for a fire alarm system, and lastly providing that Mr. Rust gives security for a strict compliance with the ordinance. The poles and wires are to be exempt from taxes for the period of five years.

Minneapolis, Minn.—City Engineer Cappelen has been instructed by the city council to attend the National Convention of the American Society of Municipal Improvements to be held in Washington, D. C., on the 26th, 27th and 28th inst. Mr. Cappelen as the chairman of the committee on electric street lighting will submit to the society an exhaustive report on that subject which he has just completed. The report, which must have entailed lengthy and painstaking research, contains a mass of statistics showing the cost of electric street lighting in every city of any importance throughout the United States. The expenses are shown in detail, including the cost of steam plants and electric plants and their operation, machinery, miscellaneous tools, conduits, towers, lamp posts, arc lamps, clerical hire, etc.

Montevideo, Minn.—The Montevideo Roller Mills & Electric Light Company sold its mill and electric light franchise with all the appurtenances to the James Quirk Milling Company of Waterville, Minn. The electric light plant cost over $10,000 two years ago.

Monroe, La.—An election is to be held here on November 9 to vote on the question of issuing bonds for waterworks, an electric light plant and other improvements.

Mullica Hill, N. J.—A movement is assuming shape for having the town lighted by electricity.

New Orleans.—The Crescent City Electric Light Company, a new electrical concern which will soon start business here with a capital of $750,000, has secured an admirable site for its power house.

New Whatcom, Wash.—A new electric lighting plant is to be erected here to take the place of the plant destroyed by fire. Improvements costing $65,000 are to be made, the result of which will be to furnish New Whatcom with an equipment sufficient to supply the entire city with domestic and street lighting equal to any municipal corporation in the West. G. R. Loughden, an electrician, formerly of Pittsburg, Pa., has been placed in charge of the plant and will push it to an early completion.

Orangeburg, S. C.—Commissioners of Public Works J. G. Wannamaker, T. C. Doyle and T. M. Raysor are figuring on the cost of water works and an electric light plant for the city, and will have to bring it within the limit of $40,000, the amount of bonds voted for the purpose.

Rutherford, N. J.—The sale of the lighting plant of the Rutherford, Boiling Springs & Carlstadt Electric Company, which was to have taken place on the 5th inst., was postponed at the request of counsel until November 5. The sale was ordered to satisfy a mortgage of $35,000 held by the Franklin Trust Company.

Saratoga Springs, N. Y.—Albert L. Judson of Albany has applied to the board of street commissioners for a franchise for an electric light and gas plant to be established in this city.

South Milwaukee, Wis.—The mayor has vetoed the resolution passed by the council for the purchase of the electric light plant from the company now serving the city with light.

The Dalles, Ore.—The council has decided to enter into a contract with the electric light company to provide 15 arc lights for the city streets at $10.50 each per month.

West Union, O.—A. A. Kirchner & Co. of Manchester, O., have made a proposition to the town council to put in an electric light plant here and guarantee to furnish light cheaper than the gasoline lights now in use if the council will grant them a 20-year franchise.

Winona, Minn.—The council has appointed a committee to investigate the feasibility of the city operating its own lighting plant.

STREET RAILWAYS.

Abington, Mass.—The controlling interest in the Rockland & Abington Street Railway Company has been purchased by Pepper & Register, a Philadelphia firm. The road was built in 1892, and the capital is $120,000. It has been a success from the start, and has always paid an annual dividend of 6 per cent. Its first president was the late Maj. E. P. Reed, and since his death Moses W. Arnold of North Abington has been the president. The road runs from Whitman through Abington to Rockland and South Weymouth.

Atlantic City, N. J.—The Atlantic City Street Railway Company, of which Congressman Gardner is one of the promoters, has been granted a franchise to maintain a crosstown railroad in this city.

Austin, Tex.—The council has passed an ordinance granting E. A. Ellis and associates the right to build and operate a street railway in this city.

Burlington, Vt.—It is expected that the Burlington & Hinesburgh electric road, on which work is about to begin, will be completed before the 1st of July next year. The grading will be finished this fall.

Fort Smith, Ark.—A new company is to be formed here to take over the street car line and transform it into an electric system to be operated in conjunction with the electric light plant.

Frederick, Md.—The Catoctin & Myersville Electric Road, which has been building for several months, is now nearly completed. The road is five and one-half miles long and connects the Frederick & Middletown road at Middletown with Myersville. The Frederick & Middletown Company will furnish the rolling stock and operate the new road.

Hampton, N. H.—The Hampton & Amesbury Street Railroad Company have petitioned the railroad commissioners for authority to issue capital stock to the amount of $40,000 for the purpose of enabling them to construct and equip a street railway in the towns of Hampton Falls and Seabrook, location having been granted by the selectmen of both places. The capital stock of the company is fixed at $75,000.

Honesdale, Pa.—The town council is considering the proposition of a company to establish an electric street railway here. The company offers to build an opera house if they get a franchise for the railway.

Lockport, N. Y.—The Buffalo & Lockport Railway Company has equipped one of the local cars with electric heating appliances, and if these prove satisfactory will similarly equip all their cars.

Logansport, Ind.—The Business Men's Association of this city have been granted right of way through Carroll county for the proposed Logansport & Burlington Electric Railway. Some time ago this association secured the franchise for an electric road from Logansport to Rochester in Fulton county, and later a franchise was granted from Rochester to Winona, in Kosciusko county, with a branch to Manitou lake. Thus the right of way for a continuous line from Burlington, in Carroll county, through Logansport to Winona, about sixty miles, has been secured. The organization of a company for the construction of the road will be undertaken at once, local capital along the line being largely interested.

Lyons, N. Y.—The construction of an electric railroad between Marion and Palmyra is again being talked of. Charles Tassell of Marion is securing the right of way for the proposed road, and it is claimed that part of the necessary capital has been subscribed. It will cost about $70,000 to construct the line.

Media, Pa.—A deed has been filed at the recorder's office here conveying all the property and franchises of the Philadelphia, Castle Rock & West Chester Railway Company to the Philadelphia & West Chester Traction Company.

New York.—President Vreeland states that owing to unexpected difficulties encountered in laying the conduits, the Sixth and Eighth avenue lines, whose motive power is being changed to underground electric, will not be completed before December 1. He thinks the Broadway line will not be finished before spring.—The railroad committee of the municipal assembly has under consideration a proposed ordinance providing for illuminated signs at night on all street cars indicating their destination; for bringing cars to a standstill while passengers get off and on; for refunding fares to passengers in case of obstruction by fires or other obstacles lasting over five minutes; for low steps; for proper lighting of cars to enable passengers to read with ease, etc., etc., and empowering the mayor to appoint inspectors at suitable salaries to see that the provisions of the ordinance are obeyed.—The report of the railroad committee advising that trolley cars on the Brooklyn bridge be required to keep 102 feet apart under a penalty of $25 for each offence was unanimously adopted by the council.

Nyack, N. Y.—The Nyack Traction Company has prepared plans and specifications for the new car barn and power house to be built. Drawings are being made and bids will be asked for in a short time.

Ottawa, Ill.—H. L. Bishop, master in chancery of the United States District Court, on the 7th inst. sold the defunct Streator street railway here for $14,000 to C. S. Barr of Streator, the principal bondholder.

Richmond, Va.—The projected trolley road from Richmond to tidewater at Gloucester Point or that vicinity has aroused so much interest in this city and along the line that a company has been organized to take the enterprise in hand. The incorporators are G. E. Detwiler and a Mr. Enright, of Amelia County, Va.; G. E. Picot, of Richmond; L. C. Catlett, of Gloucester, and Messrs. Taylor and Hunton, of New York. An election will be held at Gloucester on the 8th of November to get the public vote on the question of issuing bonds to aid in carrying out the scheme.

San Antonio, Texas.—An electric freight railway about two miles long is now in operation in this city. The line is owned and operated by the Texas Transportation Company. It extends from the yards of the Southern Pacific Railroad through the streets of the city to a station at the City Brewery, and has a number of spurs reaching the warehouses and storage rooms of the brewery.

San Luis Potosi, Mexico.—A company has been formed for the purpose of building a narrow gauge electric railroad from this city to the mining district of Rio Verde, 66 miles southeast of here. The name of the company is the Potosi & Rio Verde Railway Company. It has a capital stock of $200,000. The directors are George F. Peabody, Edward M. Shepard, A. Foster Higgins, Chas. J. Nourse, Jr., Herbert H. Dean, Samuel H. Ordway and Francis N. Holbrook, all of New York City, and Donald C. Brown and Robert S. Towne of St. Louis. A concession for the proposed road has been obtained from the Mexican Government, and the work of construction will commence in a short time. The road will be used to handle ore from the Rio Verde mining camp to the smelter in this city.

South Peoria, Ill.—The formal opening of the street car line here on the 6th inst. was celebrated in great style. Bunting was liberally displayed, a band played patriotic airs and there was general jollification.

Springfield, O.—An electric railway from this city to Dayton is projected.—The capital stock of the Dayton, Springfield & Urbana Railway Company is to be increased to $1,000,000.

MANUFACTURING, ETC.

Chester, Pa.—The Morris Arc Light Company has received its charter from Harrisburg, and will now proceed with the manufacture of its lamps.

Utica, N. Y.—The Utica Electric Manufacturing & Supply Company has closed a contract for a dynamo, switchboard and 11 arc and 200 incandescent lamps for the New York Mills Company. The plant will be installed at once.

Washington, D. C.—By direction of the Paymaster General of the Navy the opening of proposals for furnishing the Norfolk, Va., Navy Yard with one electric traveling crane has been postponed from October 18 to October 29, 1898. Contractors desiring to bid on this work can obtain full information by addressing the Bureau of Supplies and Accounts, Navy Department, Washington, D. C.

TRANSMISSION PLANTS.

Quebec, Can.—The Shawinigan Water & Power Company have let the contract for the construction of a canal, power house, etc., at Shawinigan Falls on the St. Maurice River, Que., to a firm composed of James Barry, John Ross and John A. McRae of Niagara Falls. The contract calls for a development of 30,000 horsepower, the largest development as yet in Canada. The company proposes to develop power in the form of elec-

tricity and convey it to the city of Three Rivers, 19 miles distant, and other surrounding points. An electric tramway from the falls to Three Rivers is part of the scheme, and the promoters are convinced that electric power can also be transmitted to Montreal, a distance of about 80 miles. The contract awarded to Barry, Ross & McRae represents between $300,000 and $400,000, but the whole expenditure will amount to at least $1,000,000.

COMPANY MATTERS.

Ottawa, Ont.—The Metropolitan Electric Company has been granted a charter by the city council and will apply to Parliament for incorporation as a company. The directors are: James Robinson and F. Caines, Montreal, A. B. Broderick, T. Lindsay and W. Arnold of Ottawa.

Peoria, Ill.—The Diamond Electric Company's works here were sold on the 11th inst. to George C. Bailey of Chicago, representing the John A. Roebling's Sons Company, under whose claim the factory was recently closed. Mr. Bailey's bid was $7,500 and the claim was $10,000. The difficulties of the Diamond company are attributed to a disagreement among the stockholders, and probably after reorganization the business will be continued.

Torrington, Conn.—In accordance with an action taken at a meeting held September 6, the E. A. Perkins Electric Company has increased its capital stock from $5,000 to $20,000. The company has bought the factory building owned by E. A. Perkins and two other storage buildings. No change has been made in the company and the new stock has been subscribed by the old stockholders. The company is putting in new machinery.

Warren, O.—The Packard Electric Company has reduced its capital stock from $40,000 to $10,000.

PERSONAL AND MISCELLANEA.

The Rev. Prescott Ford Jernegan has written to his parents at Edgartown, Mass., that he intends to leave his present residence in Belgium and return to America to make amends for his dealings with his fellow-men in the matter of sea-water gold and the Electrolytic Marine Salts Company, so far as he is able to do so.

John Lundie, an engineer formerly connected with the Illinois Central Railroad, has been appointed electrical expert of the Brooklyn Elevated Railroad, and will at once begin the work of preparing plans and specifications in regard to the change of motive power from steam to electricity on the Fifth and Lexington avenue lines of the company. As soon as the plans are in readiness and the specifications approved by the company's board of directors the various large electrical concerns will be asked to submit bids for the work.

Jacob Jatkowsky, the proprietor of a small dry goods store in Newark, N. J., was killed by an electric shock on Thursday night last. On closing up the store he and an assistant named Van Riper were carrying in a show case which had stood in front of the store, when the metal top of the case came in contact with a low-hanging electric light. Instantly the entire frame of the case became heavily charged with electricity and both men let go of it as the current entered their bodies. Van Riper, though dazed for an instant, was not knocked down. Jatkowsky, however, fell to the ground and lay motionless. Physicians were hastily summoned, but in spite of their attentions he died in a few minutes. The only marks caused by the electric current were a slight burn and abrasion of the skin on his right hand. One of Van Riper's hands was badly burned.

A trolley car of the Nassau Railroad, Brooklyn, on Tuesday evening of last week jumped the track at Rogers avenue and East Broadway, crashed through a wood fence, ran across Justice Curran's trim-kept lawn, and thrust a third of its length through the Judge's dining room window while the family were at dinner. They were badly frightened for the moment, but as no one was hurt, the ludicrousness of the intrusion soon set them all laughing. There were no passengers on the car, and the motorman and conductor jumped off when it left the track.

RECENT COMPANY ELECTIONS.

Albany Railway Company, Albany, N. Y.—Directors: Robert C. Pruyn, Anthony N. Brady, A. Bleecker Banks, John W. McNamara, James H. Manning, James McCredie, William McEwan, Elnathan Sweet, James Rooney, John G. Myers, S. W. Rosendale, Clarence N. Flack and William J. Walker.

Cayadutta Electric Railroad Company, Gloversville, N. Y.—President, J. Ledlie Hees; first vice-president, Thomas E. Ricketts, Johnstown; second vice-president, Alvah J. Zimmer, Gloversville; secretary and treasurer, George M. Place, Gloversville.

Columbia Traction Company, Harrison, N. J.—President, Franklin G. Simmons; treasurer, William C. Allen; secretary, Ernest B. Foster. The company, organized under the laws of New Jersey, is to operate an electric railway between the city of Hudson and the village of Philmont, N. Y., and furnish lights to the various municipalities through which the road will run.

Edison Electric Illuminating Company, Boston, Mass.—At the annual meeting on the 15th inst. the old officers and directors were re-elected with the exception of Director E. F. Whitney who has been succeeded by William Powell Mason.

Rockland, Thomaston & Camden Street Railway Company and the Knox Gas & Electric Company, Rockland, Me., have re-elected the old officers and directors as follows: President, George E. Macomber; treasurer, A. D. Bird; clerk, Herbert M. Heath; superintendent and manager, Thomas Hawken; directors: G. E. Macomber, John F. Hill, S. M. Bird, W. S. White, W. F. Cobb, A. F. Crockett and H. L. Shepherd.

Schuylkill Valley Traction Company, Norristown, Pa. (reorganization).—President, C. D. Beebe; general manager, secretary and treasurer, R. M. Douglass; superintendent and electrician, A. G. Davids; directors: C. D. Beebe, N. H. Larzelere, R. M. Douglass, Thomas Corday, D. B. Shepp, H. S. Holden and G. B. Leonard.

Standard Light & Power Company, Montreal, Can.—President, W. McLea Walbank; vice-president, J. H. Burland; secretary, E. Craig; directors: W. McLea Walbank, J. H. Burland, Peter Lyall, W. S. Evans, L. H. Heneault, F. Dagenais and M. P. Davis.

Utica & Deerfield Street Railroad Company, Utica, N. Y.—President and general manager, Frederick B. Weaver; secretary and treasurer, W. Pierrepont White.

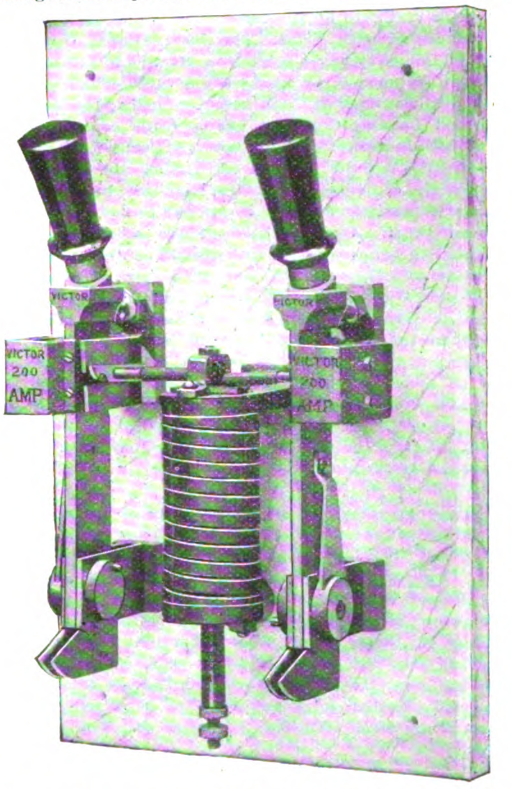
COMMERCIAL PARAGRAPHS.

A New Circuit Breaker.

Below we illustrate a new circuit-breaker which has been on the market for several months and has been used on some of the largest installations in New York City; it is worthy of mention owing to its many advantages over other circuit-breakers and the many new and novel features which are embodied in the construction of the instrument. The action is also new and radically different from any other instruments on the market.

This circuit-breaker is manufactured by the firm of F. A. LaRoche & Co., 13th and Hudson streets, New York City, who are also the manufacturers and owners of the "Ideal" circuit-breaker, which has heretofore been mentioned in the various journals. They also manufacture a full line of switches, switchboards and all kinds of switching devices.

The new circuit-breaker's trade name is "Victor," and the name is a very appropriate and deserving one. The style of this circuit breaker is of the fly-out action, but the danger to the operator is reduced to a minimum owing to



the shortness of the blades and the momentum being checked or broken as soon as the circuit is interrupted.

They are made of the independent action, that is to say, each blade is separately thrown in and controlled, and in case of a short circuit or overload both blades simultaneously open up, the action in that respect being similar to the well-known "Ideal" circuit-breaker, which was the first circuit-breaker put on the market with this novel feature.

Neither the "Victor" nor "Ideal" can be closed as long as the overload or short circuit exists in the line. As soon as the blade is thrown in, and you attempt to throw the opposite blade in, the blade already in the clips will open up independently of the blade being closed, thereby making it unnecessary to use knife-switches in conjunction with these circuit-breakers. Each blade has a separate latch and catch which acts on the roller principle, reducing the friction to a minimum. Also, each blade is independently hinged on a self-locking hinge post, which by the act of closing the blades compresses the blades of the hinge post, and which can be compressed to any degree, as this locking device is graduated and is adjustable, and can be set with a pressure of 1,000 pounds to the square inch of pressure between the clips and blades, therefore always making that a solid mass of copper.

It has never yet been known that any of these breakers became heated at the hinge post with double the amount of current passing through for what it is intended. The breaker is equipped with new style carbon breaks of liberal capacity, so adjusted that the blades have left the conducting clips one inch before the break taking place on the carbon, thereby preventing burning of the clips, freezing and cutting, which so often cause trouble with switches and circuit-breakers.

The solenoid is differentially wound, which concentrates the force to the hole of the solenoid, very little current passing through the outer coil. The coils on the circuit-breakers from 100 amperes up are wound with bare copper and carefully insulated, yet when the coil is completed it looks like one solid spiral of copper. It is as yet the neatest method employed in making coils for automatic switches. The entire circuit breaker is made up of cold hard-drawn copper, no castings being used throughout its entire construction.

The whole conducting parts of this circuit-breaker are calculated on a basis of 750 amperes to the square inch sectional area. Each blade has an independent plunger and copper steel spring, which can be removed if required from the front or back of board as may be desired.

Another advantage of this circuit breaker is the few number of holes that need be drilled in the switchboard—only seven holes being required to hold the circuit-breaker in place and on the board. The range of adjustment is large, namely, a circuit-breaker with a normal rating of 200 amperes can be adjusted to break a circuit anywhere between 100 and 400 amperes.

They are also made with underload attachment. Every one of these circuit-breakers is carefully and accurately calibrated, and they are as reliable as any ampere-meter on the market.

Large Orders for Spiral Riveted Pipe.

The great strength and durability of this style of water pipe, the ease with which it may be handled, and the fact that it is not liable to give trouble through leakages, has brought a steadily increasing demand for Root's Spiral Riveted Pipe.

The Abendroth & Root Manufacturing Company, 28 Cliff street, New York, sole manufacturers, report a number of large orders recently received.

To the Sheely & O'Shee Company, contractors, of Lincoln, Neb., they have lately shipped 12,000 feet of their pipe which will be used in extending the waterworks at Lanesboro, Minn.

About 10,000 feet have been sent to Milledgeville, Ill., and 15,000 feet to the city of Augusta, Wis.

The U. S. Water & Steam Supply Company, contractors, Kansas City, have placed an order with the company for about 5,000 feet of pipe which will be used at Concordia, Mo., and 6,500 feet are to go to J. L. White, contractor, Wyoming, Ill.

Removal Notice.

The general Eastern office of the Siemens & Halske Electric Company of America has been removed to the Land Title Building, Philadelphia, Pa. Their New York office for local business (metropolitan district) is now located at Room 511, Cable Building, 621 Broadway, New York City.

The Electric Appliance Company, Chicago, are calling attention to their new self-contained automatic hook. This hook is exclusively the Electric Appliance Company's design and manufacture, and a number of very strong claims are made for it. It is very easy to install and occupies very little space. It is put together complete and adjusted before shipping, and is therefore sure to reach the customer in good shape. The contacts are always visible upon opening the door, which makes it easy at any time to see that everything is in working order. The hook is constructed with a cam at the back to prevent the lever being bent back out of shape. This hook is apparently a very desirable article.

INCORPORATIONS.

The Electric Railway & Manufacturers' Supply Company, San Francisco, Cal. Capital stock, $50,000, of which $500 has been subscribed. Incorporators: Allan S. J. Boure, S. H. Taylor, Frank Frisble, Harry P. Bowie and H. S. Hagan.

The Sedalia Electric & Railway Company, Sedalia, Mo. Capital stock, $400,000. Incorporators: C. H. Reeve, J. C. DeLong, J. C. Van Riper, W. O. Evans and A. M. Trader.

The Cincinnati, Milford & Goshen Street Railway Company, Cincinnati—to build an electric or other railway between Linwood, in Cincinnati, and Goshen, Clearmont

County, running along the Cincinnati, Columbus & Wooster turnpike, through the village of Milford. Capital stock, $10,000. Incorporators: Frank A. Goodwin, Frederick E. Niederhelman, William C. Compton, Lennox C. Goodwin and S. W. Kittering.

ELECTRICAL PATENT RECORD.

Letters Patent Issued October 11, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

612,062. Trolley-Arm. Benjamin R. Shopp, Jr., Jersey City, N. J. Filed March 15, 1894.

612,068. Switching Mechanism. George W. Singleton, Syracuse, N. Y., assignor to Peter J. Ramion, John A. Henesey and Matilda E. Ramion, same place. Filed Jan. 18, 1897. Renewed March 5, 1898.

612,068. Electric Railway. Frederick D. Sweet, Elyria, O. Filed Nov. 22, 1897.

612,182. Electric Trolley Device. Charles L. Jeffrey, Johnstown, Pa., assignor to the Steel Motor Company, same place. Filed Jan. 12, 1898.

612,284. Electric Traction Apparatus. Raoul Demeuse, Brussels, Belgium. Filed July 23, 1897.

612,255. Trolley-Pole. Virgil A. Mason, Austin, Tex., assignor of one-half to Elizabeth Covert, same place. Filed April 20, 1898.

612,344. Underground Electric Railway. Charles W. Jenkins, Richmond, Va., assignor to Wilton F. Jenkins, same place. Filed Oct. 28, 1897.

612,351. Trolley-Wheel Support. Edwin Lane, Johnstown, Pa. Filed June 28, 1897.

612,021. Car-Fender. Cyrus Coplantz, Joliet, Ill., assignor to Hugh L. Coplantz and Frank E. Cheesman, same place. Filed May 31, 1898.

612,340. Car-Fender. Morris Hirsch, New York City. Filed March 13, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

612,049. Arc-Lamp Globe. Henry G. Mills, Milwaukee, Wis. Filed May 10, 1897.

612,[illegible]. Casing for Electric Car-Lighting Apparatus. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place. Filed Nov. 26, 1897.

612,152. Electric-Lamp Socket. Frank M. Bell, New York City, assignor of one-half to Wilma Pollack, same place. Filed Jan. 10, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

612,015. Lightning-Arrester. Cummings C. Chesney, Pittsfield, Mass., assignor to John F. Kelly, same place. Filed Jan. 15, 1898.

612,038. Electric Switch. Gerald W. Hart, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company of Connecticut. Filed Oct. 28, 1896.

612,122. Electrical Converter. Ferdinand Schwedtmann, St. Louis, Mo. Filed Aug. 28, 1897.

612,146. Electric System of Distribution. Joseph N. Thomas, Johnstown, Pa., assignor to the Johnson Company, Lorain, O. Filed Feb. 15, 1898.

612,192. Hinge Conductor for Electric Currents. Frank E. Chandler, Brandon, Vt. Filed Jan. 8, 1898.

612,208. Controlling-Switch for Electric Motors. Reese Hutchison, Mobile, Ala., assignor of three-fourths to James H. Wilson and Joseph A. Maloney, same place. Filed Feb. 17, 1898.

612,212. Rheostat. Edwin O. Raster, Chicago, Ill., assignor to the Raster Carbon Rheostat Company, same place. Filed April 11, 1898.

TELEPHONE AND TELEGRAPH APPARATUS.

612,172. Telephone Arm-Rest. James R. McKelvey, Lawrenceville, Ga. Filed Aug. 23, 1897.

612,219. Telephone Central Station Apparatus. Julius H. West, Berlin, Germany. Filed July 8, 1896.

612,286. Circuit-Controller and Receiver-Support. Luis Duque, Paris, France, assignor, by direct and mesne assignments, of two-thirds to Addison Bybee, Chicago, Ill., and H. E. Freudenthal, Pioche, Nev. Filed Aug. 21, 1897. Renewed June 9, 1898.

612,330. Telephone Pay-Station. William Gray, Hartford, Conn., assignor to the Gray Automatic Telephone Pay Station Company, same place. Filed Nov. 21, 1895.

MISCELLANEOUS.

612,009. Process of and Apparatus for Electrolyzing Sea-Water. Giovanni B. Baldo, Triest, Austria-Hungary. Filed Oct. 5, 1896.

612,250. Process of Electrolytic Separation of Metals. Heinrich von der Linde, Crefeld, Germany. Filed Nov. 19, 1897.

612,326. Electric Battery. Manes E. Fuld, Baltimore, Md. Filed Aug. 4, 1897.

RE-ISSUE.

11,697. Conduit-Outlet Insulator. Frederick W. Erickson, Boston, Mass., assignor of one-half to Eric E. Erickson, same place. Filed June 25, 1898. Original No. 566,507, dated Aug. 25, 1896.

TELEPHONE AND TELEGRAPH.

A New Opposition Telephone Company.

On Wednesday last the People's Telephone Corporation of New York filed articles of incorporation at Albany, and it is asserted that they have already acquired a franchise and have the capital necessary to equip exchanges, lay wires and supply 40,000 or 50,000 subscribers with new and improved instruments. The company is formed as a result of the agitation against the alleged exorbitant charges of the Bell Company in New York, and has at its back the Board of Trade and Transportation, who have vainly fought for legislative aid in getting lower rates at several sessions of the Legislature. Mr. Frank S. Gardner, secretary of the board, has publicly explained the purposes of the new organization. He says the new company intends to cut the unlimited service rate, which is now $240 per year in Manhattan, to $100, and the present minimum rate of $90 for 600 messages to $40 for 400 messages. The residence message rate for service on private wire is to be $30, and families living in apartments and flats are to be furnished with an unlimited service on group lines for $1 per month. In Brooklyn, the unlimited service rate of $150 is to be cut to $75. The inter-borough charge is to be cut to five cents per message. The company will guarantee that such rates shall continue five years. Connections for long distance telephones are also to be made. The officers of the company, elected Thursday last, are: President Darwin R. James, president of the Board of Trade and Transportation; vice-president, Elias S. A. de Lima, of the commission firm of D. A. de Lima & Co.; secretary, Frank S. Gardner; treasurer, Silas B. Dutcher, president of the Hamilton Trust Company.

In Cuba telegraphic communication exists between the different interior towns and principal villages over lines that were erected by the Spanish Government, erected in the rudest fashion, many of the wires resting on trees without the vestige of an insulator. There are four cable lines connected with Cuba. The International Ocean Telegraph Company has a cable from Havana to Florida; the Cuban Submarine Company has a cable connecting Havana with Santiago de Cuba and Cienfuegos; the West Indian and Panama Company has a cable connecting Havana with Santiago de Cuba, Jamaica, Porto Rico, the Lesser Antilles and the Isthmus of Panama; the Compagnie Francaise de Cables Sous-Marins has a line connecting Havana with Santiago de Cuba, Hayti, San Domingo, Venezuela and Brazil. An English cable between Santiago de Cuba and Cienfuegos connects with a land line giving communication with Havana. The only three towns in Cuba having cable connections are Havana, Cienfuegos and Santiago de Cuba. The Statesmen's Year Book for 1898 is authority for the information that there are 2,300 miles of telegraph line with 153 offices in Cuba. The principal towns in Cuba are lighted by electricity, as are also the greater number of the sugar estates. There are about 475 miles of telegraph lines in operation in Porto Rico, and submarine cables connect San Juan with St. Thomas and Jamaica.

At the annual meeting of the stockholders of the Home Standard Telephone Company held at Albany, N. Y., on the 11th inst., the following officers and directors were elected: President, John M. Bailey; vice-presidents Henry Russell and James Rooney; treasurer, Howard Hendrickson; secretary, Charles L. A. Whitney; directors: John M. Bailey, Henry Russell, John A. McCarthy, John H. Farrell, William P. Rudd, Charles L. A. Whitney, James B. Lyon, Howard Hendrickson, James Rooney, Ten Eyck T. Mosher, John Wagner, Wm N. S Sanders, Thomas W. Cantwell, William H. Keeler and Frank B. Delehanty.

Judge John A. Williams of the U. S. District Court has issued an order restraining the city of Helena, Ark., from enforcing an ordinance regulating the rates of the Southwestern Telegraph and Telephone Company which the council passed recently. The ordinance makes the rates for telephone service $1.50 per month for residences and $2.50 for business offices. The passage of the ordinance was fought bitterly by the company, which claims that the constitution does not permit a city council to regulate its rates. On the other hand, the city sets up the fact that the same company is furnishing other cities in the State, namely, Little Rock, Pine Bluff and Fort Smith, with the same service at even lower rates, and they simply want to be treated as other towns are. The case will be fought to a finish in the courts.

The subscribers to the telephone service of the Chesapeake and Potomac Telephone Company in Washington, D. C., met a few evenings ago in Willard's Hall and formed a permanent organization for the purpose of providing ways and means to prosecute the suits brought against the company to enforce compliance with the recent Act of Congress regulating the rates for telephone service in the District of Columbia. At the conclusion of the speeches it was decided by unanimous vote that the subscribers who pay $100 or over for the use of a telephone shall pay $5 monthly into the association's fund, and those who pay less than $100, $2.50 per month. In addition to those who were already contributing members, thirty-five new members signed.

The executive committee of the National Association of Fire & Police Telegraph Superintendents and Municipal Electricians met at Wilmington, Del., on the 8th and 9th inst., to consider arrangements for the convention of the association next year which is to be held in Wilmington. The Board of Trade appointed a committee to assist in entertaining the visitors. The tug Laura B. was chartered to take them on a trip down the river and a dinner was provided for them at Delaware City. Everything conspired to make their visit a pleasant experience. The principal work of the committee was revising the by-laws of the association and discussing arrangements for the next annual meeting, one of the features of which will probably be an exhibition of electrical supplies.

The Conway Telephone Company is now building a line from Tishomingo, I. T., to Denison, Tex. The line is constructed as far as Emet and will come down the Washita river from there to Linn, from Linn to Cumberland, Cliff, Grantham and small towns in that section, then across country to Mead and to Colbert and from Colbert to Denison. This is an extension of the line that now runs from Tishomingo to Oakland and from Oakland to Ardmore. It will connect every town in the Chickasaw nation by telephone in the near future, and it is expected that it will be in operation into Denison by the middle of December or perhaps before that time.

The New Telephone Company of Indianapolis has been granted a franchise in Anderson, Ind., and has made a contract with the Overshimer company of Elwood, an independent organization, by which all patrons of the latter may use the New Company's toll lines. The New Company expects to have its Anderson exchange in operation before the 1st of January.

A representative of the Mutual Telephone Company addressed the council of Waterford, Pa., at its last meeting, laying before them a scheme for the establishment of a local telephone exchange. The members were favorably impressed, and an ordinance will be introduced at the next meeting granting him a franchise.

The West Virginia Telephone Company has been granted a franchise in Sistersville, W. Va. The old McGhie & Moore line, which has been in operation about six months, has been ordered removed and the new company will get full possession of the field.

The Pan Telephone Company has resumed operations at Fort Smith, Ark., having purchased the plant from L. E. Ingalls which had been sold to him by Col. James Brizzolara who had obtained it by purchase at a judgment sale to satisfy a claim of Ingalls against the original company.

The franchise of the Atlanta Telephone Company to build, equip and put in operation a new telephone system in Atlanta, Ga., has been extended until May 1, 1899. The extension was granted by the general council.

The ordinance of the Chattanooga council granting J. A. Helvin a franchise for the establishment of a new telephone system in that city has been renewed and extended to February 1, 1899.

The Drawbaugh Telephone & Telegraph Company of Philadelphia has filed plans for its proposed system in that city with the Board of Highway Supervisors.

New Companies Incorporated.

The Panhandle Telephone Company, Moundsville, W. Va. Capital stock, $50,000.

The Thomasville Telephone Company, Thomasville, N. C.—to establish a telephone system in Thomasville and surrounding country. Capital stock, $6,000. Incorporators: F. S. Lambeth, J. W. Lambeth, C. A. Julian, J. F. Haden and others.

The Grand Prairie Telephone Company, Hazen, Ark. Capital stock, $10,000, of which $1,000 has been subscribed. Incorporators: Geo. D. Foster, J. G. Thweats, J. M. McClintock, A. L. Aydelott, David Brockaway and others.

The People's Telephone Corporation of New York—to operate a telephone system in New York City and in other cities, towns and villages in New York and other States and in the Dominion of Canada. Capital stock, $5,000,000, divided into $2,000,000 preferred and $3,000,000 common stock. Directors: S. B. Dutcher, J. E. Nichols, E. S. A. De Lima, Francis C. Travers, Frank Brainard, J. Fred Ackerman and Darwin R. James of New York City.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; * inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Oct 17:						
Albany Ry. Co	100	2,000,000	$1,750,000	1¼ % Q., Aug. '98.	151	158
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug., 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	•	..
Allentown Pa.—Oct 17:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Oct 17:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Oct 17:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98.	65	65½
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	23	23½
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	...	..
Boston, Mass.—Oct 17:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	...	12
North Shore Traction Co....com.	100	4,000,000	4,000,000	....	10¾	12
North Shore Traction Co....pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	78½	80
b West End Street Ry. Co....com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	85¾	86
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	105	106
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	69¾	70
Brooklyn N. Y.—Oct 17:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	64¼	64½
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR.......guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	217	220
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000		..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	..	240
Kings County Elevated	....	4,750,000	4,750,000		5	5¾
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad.......pfd.	......	6,000,000	6,000,000	....	70	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Oct 17:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	65	66
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	79	81
Columbus O.—Oct 17:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Aug., '98.	53	54
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Oct 17:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '98.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Oct 17:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q.	290	291
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12½	13
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Oct., 98.	215	217
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Oct. 98	92¾	93¼
jChicago West Div. Ry.......guar.	100	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Oct 17:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry.......pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000		23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	117	117¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Oct 17:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	39	41
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	70	74
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98	79¾	81
Detroit, Mich.—Oct 17:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	.
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	.
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Oct 17:						
City Railway Co..............com.	100	1,500,000	1,470,600	1¼ % Q., Jan.1,'98.	105	..
City Railway Co..............pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	103

* Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Oct 17:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	3 % S., Jan., '98	140	—
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	—
Holyoke Mass.—Oct 17:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	180	200
Hoboken, N. J.—Oct 17:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	—
Indianapolis, Ind—Oct 17:						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	24	25½
Lancaster, Pa.—Oct 17:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	—
Lancaster & Col. Electric Ry	....	....	87,500	....	..	—
West End Street Railway	....	....	....	....	..	—
Louisville, Ky.—Oct 17:						
Louisville Ry..............com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	35	39
Louisville Ry..............pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	101	..
Minneapolis, Minn.—Oct 17:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	27	30
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,714,200	1¾ %, Jan., '98.	99	101½
Montreal, Canada.—Oct 17:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	275½	276
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	103½	104
Memphis, Tenn.—Oct 17:						
Memphis Street Railway Co	100	500,000	500,000	....	15	—
New Haven, Conn.—Oct 17:						
Fair Haven & Westville RR	25	1,500,000	900,000	1 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—Oct 17:						
Canal & Claiborne RR. Co	40	240,000	240,000	1 % S., Jan., '98.	150	..
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	121½	125
New Orleans Traction Co.......com.	100	5,000,000	5,000,000	....	1½	8½
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	9	11
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	1½	32
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	83	85
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23	25½
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	52½	55
New York—Oct 17:						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98.	170	190
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98.	159¾	160
eBleecker St. & Fulton Fy.Ry.guar	100	900,000	900,000	¾ % A., July, '98.	34½	37
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	219½	225
gCen.Park,N.&E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	177	185
hEighth Avenue RR	100	1,000,000	1,000,000	....	348	365
i42d St. & Grand St. Ferry RR.guar	100	750,000	748,000	4½ % Q.	360	365
jNinth Avenue RR.........guar.	100	800,000	800,000	....	165	..
kSixth Avenue RR...........guar	100	2,000,000	2,000,000	....	200	215
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	310	..
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	178	182
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. '98.	151½	153
m42d St.,Manhatv'le & St.Nich.Av	100	2,500,000	2,500,000	....	64	65
*Union (Huckleberry) Ry	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Oct 17:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	50	50½
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Oct 17:						
Allegheny Traction Co	50	500,000	500,000	....	...	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	21⅛	...
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	..	56½
pCentral Traction Co	50	1,500,000	‖900,000	....	..	...
qCitizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	64½	65
rDuquesne Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	..
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	‖2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	..	...
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

* Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Oct. 17;						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass—Oct 17:						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Oct 17:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Oct. 17:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Oct 17.						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	70	72
Philadelphia.—Oct 17:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvi'e, Man. & Fairm't..6 % pfd.	50	588,900	‖588,900	3 % S—July, '98	67	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	8 % Feb. 1, '98.	65½	66
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450	....	19⅞	20
cElectric Traction Co	50	....	8,297,920	....	71½	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	3.7	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	394	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	..
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	265	...
ePeople's Traction Co	50	10,000,000	†6,000,000	8 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135	136
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	8 % Jan., 1898.	186	...
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p sh., Oct. 98.	9⅓	90½
iCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	...
iContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
iEmpire Passenger Ry. Co	50	600,000	‖600,000	....	..	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	170	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$8.50 share July '98	90	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	285	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖835,000	$11 sh. A., July, '98	275	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	280
Rochester, N. Y.—Oct 17:						
Rochester Railway Co	100	5,000,000	5,000,000	....	12	20
Reading, Pa.—Oct 17:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	...
St. Louis Mo.—Oct 17:						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1½ % Oct., '98.	129	130
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	..	..
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '98.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % Oct., '98.	170	175
People's RR. Co	50	1,000,000	800,000	50c., Dec., '89.	..	..
Southern Electric Ry..........com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry.......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	114	116
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	52½	53½
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Oct.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	108	109
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	54⅞	55
Presidio & Ferries RR	100	1,000,000	550,000	....	9	..
Scranton, Pa—Oct 17:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Oct 17:						
Springfield Consolidated Ry	100	750,000	750,000	....	—	11
Springfield O.—Oct 17:						
Springfield Street Ry	100	1,000,000	1,000,000		..	2
Springfield, Mass.—Oct 17:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	195	205
Toronto Canada.—Oct 17:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¼ % S.	103½	104
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	275½	276
Washington, D. C.—Oct 17:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	78	78⅛
Columbia Ry. Co	50	400,000	400,000	6 % A.	75	..
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	..	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	..	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	125	126
Worcester, Mass.—Oct 17:						
*Worcester Traction Co.......com.	100	3,000,000	3,000,000	....	15¼	16¼
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	96	97¼
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Oct 17:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
ij Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a. in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Oct 17:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., July, '98.	276	276½
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '98.	75	76
New England Telephone Co	..	10,394,600	10,304,600	$1.50 %, Aug. '98.	136	..
New York.—Oct 17:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	96	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	109	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	179	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	45
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	71	75
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	..
*International Ocean Tel Co.guar 6 %	100	3,000,000	......	1½ % Q.	110	112
Mexican Telephone Co	100	2,000,000	......		..	.98
*New York & New Jersey Tel. Co	100	5,000,000	3,728,000	1¼ % Q., July, '98.	150	15 ½
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	78	18
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co. guar. 5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., July, '98.	110	112
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	91½	91¾
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Oct 17:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	171	..
Chesapeake & Potomac Telep. Co.	100	......	......	....	50	—
Chicago Telephone Co	100	......	......	......	242	..
Central Dist Prtg & Telg. Co. (Pgh.).	100	750,000	750,000	....	132	134½
Empire & Bay States Telegraph Co.	...	......	......	....	74	78
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	76	77
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	110	113
Providence (R. I.) Teleph. Co	50	....	......	....	87	90
Southern New Eng. Teleph. Co	100	3,000,000	......	....	121	125

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Oct 17:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	—	..
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new] ...... "	100	18,276,000	18,276,000	......	75⅜	75½
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	3
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	....	33⅓	34½
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	57	58
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Oct 17:						
Edison Elec. Ill'g Co., New York	100	9,188,000	7,988,000	....	120½	125
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '98	..	..
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	28	30
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	—
General Electric Co. [new].... "	100	18,276,000	18,276,000	......	75⅜	75½
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.—Oct 17:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	130	140
East End Electric Light Co	50	300,000	300,000	Q	..	30
Philadelphia, Pa.—Oct 17:						
Edison Electric Light Co	100	2,000,000	......	......	144½	.
*Electric Storage Battery Co..com.	100	8,500,000	......	......	27¾	28¼
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	44½	45
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co	10	6,500,000	550,000	$82500 dis. Jan.11'97	13¾	14
Southern Elec. Light & Power Co	10	187,500	187,500	....	16	..
Miscellaneous.—Oct 17:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	32	35
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	13
Eddy Electric Mfg. Co	25	......	......	....	—	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	122	127
Hartford (Conn.) Lt. & Power Co	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	170	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	84	87
Rhode Island Elec. Protec. Co	100	......	......	....	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2 % Q	156¾	159½
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	‡135	135¼
Thomson-Houston Welding Co	100	......	......	3 % S., Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	. ....	.....	..	95	100

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Oct 17:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb. 1, '98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, 98.	85	87
New York.—Oct 17:						
Consolidated Electric Storage Co	...	......	....	. ..	18	20
Edison European	..	......	....	. ...	1	3
Safety Car Heating & Lighting Co	100	......	....	......	100	105
Worthington Pump Co.......com.	100	5,500,000	5,500,000	......	32	35
Worthington Pump Co.........pfd	100	2,000,000	2,000,000	7 %	96	99
Philadelphia, Pa.—Oct 17:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	—
Electro Pneumatic Trans. Co	10	1,500,000	......	....	1	1½
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	..	20
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	67½	68
Welsbach Light Co	5	525,100	......	....	45	46½
Welsbach Light Co., Canada	5	500,000	......	....	..	3½
Pittsburg, Pa.—Oct 17:						
Carborundum Mfg. Co	100	200,000	200,000	....	—	—
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	117	119
Miscellaneous.—Oct 17:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	—	15
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	—	85
Billings & Spencer Co	25	......	....	....	30	30
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	32	35½
Johns-Pratt Co	100	......	....	....	90	100
*Pratt & Whitney Co...........com.	100	......	....	....	1	3
*Pratt & Whitney Co...........pfd	100	......	....	....	45	50
Stillwell-Bierce Co.............com.	..	......	....	....	70	80
Stillwell-Bierce Co..............pfd.	..	......	......	2 % Sept. 1, '97.	96	98
Shultz Belting Co	100	500,000	......	....	68	72
St. Charles Car Co	—	......	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Oct 17, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry.................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112⅛	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR.1st mtg. 6s	850,000	850,000	1919	M. & N.	*119½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..................1st 5s	....	....	......	......	*105½	108

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Oct 17, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115⅛	117
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115⅛	116
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	102¾	103¼
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115⅛	116
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	102½	104
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	.
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	118	120
City & Suburban Ry......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	115	115¾
Lake Roland Elev. ....1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113⅝
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	120

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	104¾
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M.& N.	105	105⅝
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	101	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR..........1st mtg. 5s.	500,000	47,000	1906	J. & J.	.. .	....
†Charleston City Ry...........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102⅛	102⅝
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T..............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	105¼	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	59	60
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¼	101½
North Chicago St. RR.....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry......consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	107	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	101½
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	95	......
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Oct 17, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	105	105⅛
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	......	119⅛
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	....	135

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	105	105⅛
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	103	104½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	98½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	...
The Detroit Ry................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	106	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR.....Deben. g.	100,000	94,000	1909	M. & S.	102	......

*With interest. *Unlisted.

New Orleans La.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR..........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR.............1st mtg. 6s.	....	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	77⅛	79
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	.....
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	102¾	103¾
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	....
Orleans Railroad Co........Cons. mtg. 6s.	800,000	300,000	1912	J. & J.	.....	....
‡St. Charles St. RR. Co......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	105	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn).....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	109	......
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	120½	......
Broadway & 7th Ave..........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	107
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface..............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface..............2d mtg. 5s.	1,000,000	1,000,000	1905	......	106	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	113	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	......	......
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR.......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109½	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	99	100
Brooklyn Rapid Transit..........gold 5s.	7,000,000	5,181,000	1945	....	104	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	103	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	112	113
Central Crosstown RR.........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115¾	116⅛
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	103
Eighth Av. RR. Co......Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115⅛	117⅛
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	96	98
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	120	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	114	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	109	110
Second Avenue Ry...............Deb. 5s.	300,000	300,000	1909	J. & J.	108⅛	......
Steinway Ry. (L. I.)........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115⅛
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR.............1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124⅛	......
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	......	...
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	115
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	112⅛

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Oct 17, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.........................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	....	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry......................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	....	1943	....	105	......
Phila. City Passenger Ry......1st mtg. 5s.	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...............Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	......	94⅛
Central Traction Co................1st mtg. 5s.	375,000	375,000	1930	J. &. J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	......	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	......	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	......	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co......................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	108	109

St. Louis.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry.......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1913	J. & J.	111⅛	112⅛

*With interest.

PASSENGER RAILWAY.

St. Louis.

Date of Quotation—Oct 17, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co......................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co..............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	103
People's RR. Co....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
∥People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry...............Income 5s.	800,000	800,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	111	112
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,737,000	1918	J. & J.	114½	115½

†Controlled by St. Louis RR. Co.
‡Controlled by Union Depot RR. Co.
¶Controlled by Lindell RR. Co.
∥$200,000 in escrow to retire 1st & 2d mtg.
§$600,000 in escrow.
††$200,000 in escrow to retire 1st mtg. bds.

San Francisco Cal.

Date of Quotation—Oct, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	116⅛	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	116½
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	94	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	127½	129
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	...	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	128[illegible]	130
†Park & Cliff House RR........1st mtg. 6s.	850,000	850,000	1912	J. & J.	106	....
†Park & Ocean RR..................1st mtg. 6s.	250,000	250 000	1914	J. & J.	112	......
†Powell St. Ry.......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	120
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......

†Controlled by Market St. Ry. Co.

Washington D. C.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Belt Ry. Co. ....Cons. mtg 5s.	500,000	450,000	1920	J. & J.	......	....
Columbia Ry.......................' mtg. 6s.	500,000	500,000	1914	A. & O.	122	126
Eckington & Soldiers' Home mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	125	......

†$50,000 in escrow to retire 1st mtg. bds.

Miscellaneous.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	104	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	113	114
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	110¼	111
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	105	......
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	107½	[illegible]¾
∥Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	101	102
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	115	115½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	91½	96
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	8,000,000	2,378,000	1928	J. & J.	103	104
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	100	101
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937	....	90	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½

†$1,000,000 in escrow to retire 1st and 2d mtg. bds.
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.
∥$87,000 in treasury.
§$960,000 res'ved to redeem prior liens.
††$620,000 in escrow.

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	105¾	....

Pittsburg, Pa.

Date of Quotation—Oct 17, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1913	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......

Miscellaneous.—(Oct 17, 1898.)

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	110	115
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117	......
Edison Elec. Illg. Co. (Brooklyn)........	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis).................	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
American Bell Telephone......................7s.			1898	F. & A.	101¾	....
Northwestern Telegraph Co................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.

Date of Quotation—Oct 17, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
American Electric Heating..............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co....................	....	....	......	......	......	25
Barney & Smith Car Co.......................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co.........................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co............................	75,000	......	......	......	....	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12@12⅛c.; Lake, 12⅜@12½c.; casting, 11⅞@12c.

The Brooklyn (N. Y.) City Railroad Company declared a quarterly dividend of 2½ per cent., payable October 15.

The North Chicago Street Railway Company has declared a dividend of 3 per cent., payable October 15 to stock of record October 5.

A dividend of three-fourths of 1 per cent. was paid by the Little Consolidated Street Railway Company of Cleveland, O., on the 8th inst., for the quarter ending October 1.

The Phoenix Carbon Company of St. Louis has filed notice with the recorder of deeds in that city of an increase of capital stock from $160,000 to $500,000. The assets are given as $447,050.90 and liabilities $80,746 26.

H. E. Huntington and his associates have purchased the San Mateo Street Railway at Los Angeles, Cal., and also the street railway franchises, covering many streets in the city, owned by J. C. Kays. The syndicate already owned the greater part of the entire street railway system of the city.

The Court of Appeals, in the tax case of the Edison Electric Illuminating Company of Brooklyn, N. Y., has sustained the Special Term and the Appellate Division of the Supreme Court in that borough in their decision that the State has no power to tax a patent for an invention granted by the United States.

The directors of the Chicago Edison Company have declared the regular quarterly dividend of $2 per share, payable November 1 to stock of record October 5. The gross earnings of the company for the six months ended September 30 show an increase of approximately 20 per cent. The net receipts show an increase over fixed charges of between 11 and 12 per cent.

The Columbus (O.) "State Journal" says: "The installation of a new telephone system is being secretly agitated in the city of Columbus. It is said that enough prospective customers have been approached on the subject to indicate that the scheme will be successful. Rentals will be $36 for a business telephone and $25 for a private telephone per year."

According to the charter of the People's Telephone Company of New York the preferred stock will be entitled to 8 per cent. cumulative dividends before one on common shall be declared. The preferred is subject to redemption after five years at 110. Each of the directors has subscribed for 1,200 shares of the $5,000,000 stock. The company expects to have its plant in operation in about a year.

Spencer Trask & Co. and Vermilye & Co. offer at 93½ and accrued interest the unsold balance of $2,000,000 Edison Electric Illuminating Company of Brooklyn first consolidated mortgage 4 per cent. bonds, at which rate they will pay about 4 35 per cent. These bonds are part of $10,000,000 bonds authorized under the mortgage, but the present issue will be for only $2,000,000, the proceeds of which will be applied for the payment of the Municipal Company's stock.

On the 14th inst. the New England Telephone & Telegraph Company successfully opened long distance telephone communication between Boston and Kansas City, a distance of 1,560 miles, which marks the farthest advance yet in the science. This is thought to be near the extreme limit of successful transmission through the telephone and longer distances are only expected when some repeating system is devised. Conversation at this distance between the two cities was clearly audible.

Mr. E. L. Carr, treasurer of the United Electric Securities Company, Boston, has kindly sent us an note correcting an item which appeared in this column last week. He says: "On page 224, under 'Notes for Investors,' the United Electric Securities Company is on record as having retired $20,000 of its eighth series collateral trust 5 per cent. bonds at an average price of 102.925, leaving 236 still outstanding. This is an error, as the person who offered to sell us these bonds found on examination that his were not eighth series bonds."

The Edison Electric Illuminating Company of Boston has declared a regular quarterly dividend of 2 per cent., payable November 1. It also changed its fiscal year to end with June. For six months the report shows gross earnings of $488 964; expenses, $306,850; net, $182,113. The balance sheet shows: Cash on hand, $106,-846; profit and loss surplus, $25,343. The number of incandescent lamps connected June 30, 1898, was 161,466; arc lamps, 1,486; motors, 6,413 horse-power; compared with 138,682 incandescents, 1,446 arc, and 5,675 horse-power June 30, 1897.

The debenture certificates for 12,000 shares of the capital stock of the Narragansett (R. I.) Electric Lighting Company, to issue which the stockholders on the 8th inst. authorized the directors, are to be subscribed for on or before October 20. These certificates will not bear interest, but at the end of four years they can be exchanged for capital stock, the par of which is $50. Every stockholder of record October 8 is entitled to subscribe for one share of the new stock for every two shares now held—that is, if he has ten shares he may subscribe for five new ones at par, or he may sell his rights to the new issue. These rights have been listed on the Providence Stock Exchange.

The New York "Mail and Express" states that it failed to get an answer from the receiver of the Staten Island Rapid Transit Company to the question why with net earnings three times as large as the interest on the first mortgage bonds the road had defaulted on the October interest. The same paper says: "Two committees are industriously seeking bonds with a view to protecting the interests of the bondholders. Dick Bros. & Co. are at the head of one committee, and they are so certain of compelling the company to pay the defaulted coupon that they have been advancing the amount of the interest to stockholders depositing bonds with them. The other committee merely gives receipts for the bonds. It consists of J. W. Davis, T. Denny, Jr., and F. J. Lisman."

The Manhattan Railway Company (elevated) of New York is reported to have practically completed its plan for the electric equipment of the system, and may perhaps submit it to the stockholders at the annual meeting on November 9. The payments for damages to abutting property made by the Manhattan Company amount to date to the astounding aggregate of $13,238,715, or equal to 8.79 per cent. of the gross passenger earnings during the past nineteen years. The amount paid for this account for the year 1897-98 is stated as $861,450, contrasting with $890,281 in 1896-97, $952,296 in 1895, and as high as $1,058,642 in 1890-91. These items are included in the company's construction account.

The New York Gas & Electric Light, Heat & Power Company, the new $25,-000,000 concern recently incorporated at Albany, is causing as much speculation as to its purposes in Boston as in New York. The Boston "News Bureau" says: "It is the guess of some that the new company, counting upon its close relations with city officials, will proceed to install a large plant in opposition to all of the old companies and then precipitate a fight on rates in order to rapidly extend its business and to finally secure control of the whole lighting situation as was done in Brooklyn. In such a case there is certain to be a contest, with the Edison Company backed by the General Electric Company and the Morgan people. It is not improbable that some knowledge of the approaching contest led the Edison Company to bid for popular favor by issuing its recent circular naming lower rates for light and power service, which act is looked upon in some quarters as the inauguration of a fight which will lead to combination against combination, the outcome of which will be awaited with unusual interest by Bostonians, who are largely interested in the situation." The New York "Post" says that one of the parties interested in the new company states that it will have no plant of its own, its purpose simply being to distribute the excess of electric power of the plants of the Brooklyn Rapid Transit and Metropolitan Railway companies.

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CONTENTS.

EDITORIAL NOTES.

Lighting of Cities.

The city of Boston has of late been examining into the subject of municipal lighting. This important question has been taken up and dealt with very thoroughly, and the conclusions reached and general information gathered may prove of interest to other large municipalities. The problem to be solved was whether the city should renew the lighting contracts with outside companies, which were about to expire, or undertake to operate a municipal plant. A lengthy report dealing with this subject was submitted to the Board of Aldermen by ex-Mayor Matthews, in which he looks at the question from every possible standpoint, and compares the cost of lighting in a number of other cities with that obtaining in Boston. The total number of lights in operation nightly in that city is 2,365, of which 1,506 are operated by means of the overhead system and 538 supplied by underground mains. Besides these there are 321 lamps for park lighting. The price charged for each of the street lights is 35 cents a night and for the park lamps 34 cents, making the average price per light per annum $127.25. As shown by the report, this price compares very favorably with the cost of lighting by the municipal plant in Detroit, which is $134.57 a year for light under conditions prevailing in Boston, or with the Chicago municipal plant whose lights cost $154.80 a year. The price in St. Louis is $99.67 and in Cincinnati $110.89 a year, while the average prices in Philadelphia and New York are $143.33 and $139.90 respectively. In his report, referring to the prices charged, Mr. Matthews reaches the following conclusions:

"(1). That the prices now charged in Boston, namely, $127.75 for street and $124.10 for park lights per annum, are, if the company supplies the entire machinery and fixtures (including lamp-poles), except the circuits within the limits of the several parks, on the whole and taking into account all the differences in local conditions that are capable of being represented in dollars and cents, slightly lower than the cost upon a commercial basis of the lights furnished by the municipal plant in Detroit, considerably lower than the cost upon a commercial basis of the lights furnished by the municipal plant in Chicago, considerably lower than the prices charged for street lights by the private companies of New York, Philadelphia and Baltimore, and about the same as the prices charged by the private companies of Chicago.

"(2.) That these prices are, taking the same considerations into account, considerably higher than the prices charged for street lights by the private companies of St. Louis and Cincinnati, and slightly higher than those charged by a private company for park lights in Baltimore.

"(3.) That the St. Louis price is too low to cover depreciation or profit was agreed to by persons more or less ignorant of the business; caused or helped to cause the failure of the company and the foreclosure of its property; and that the contract when it expires will probably not be renewed except at a higher figure.

"(4). That the Cincinnati price, assuming that the lights are full 2,000 candle power, is due to the fact that the company has a long contract during which the lights are to be increased to a total of 4,000, or about twice as many relatively as Boston; and that, even after allowing for this fact, the price is probably too low to cover depreciation and profit."

Mr. Matthews concludes his report by recommending that a new contract be entered into with the lighting company, with the understanding however that the latter shall agree to furnish all the latest improvements and cheapening devices, and furthermore that every increase of 250 in the number of lights the price be reduced by one-half cent per night until 30 cents per night is reached. It is also suggested that the price of lighting be regulated, and thus the city's interests guarded, at comparatively short intervals by means of an arbitration committee composed of three members, one appointed by the city, the second by the lighting company and the third by the persons thus selected.

That municipal lighting plants are by no means economical was never more forcibly brought out than in this able report, and the city of Boston is to be congratulated on adopting a wise course and avoiding following in the footsteps of either Detroit or Chicago.

* * *

The Metric System.

This country is to-day, so to speak, stepping across the threshold of a new national career. The coming of the 20th century will find us grasping for the trade and commerce of the world. In order to secure this trade we must bid for it in terms that will be understood by the majority of nations. We must carry into the struggle no load of antiquated systems or inconvenient and cumbersome methods. For this reason it is believed that the adoption of the metric system of weights and measures would be an advantage and stimulus to our foreign commerce as well as a saving of both time and labor.

During the coming session of Congress attention will therefore be called to the fact that the present system of weights and measures militates seriously against our trade with foreign countries, owing to

the fact that American price lists are more or less confusing to foreign merchants. It will be further pointed out that the metric system, by reason of its decimal scale, its simplicity, its international character, and its unquestionable superiority to any other system of weights and measures, is worthy of universal adoption, and there will be a strong effort made to secure the enactment of a bill making it obligatory on the Government in the conduct of business to use this system. This bill was up at the last session, but failed to reach a vote. As the country has extended its boundaries since that time, as well as changed its position relative to other powers, becoming more of a factor in the affairs of the whole world, the passage of the bill should be urged not only on the old grounds, but for the new reasons to be found in the results of the war with Spain.

The advantages of the proposed system are twofold: First, it is international in character, and almost universally in use among civilized nations, and secondly, the metric system from its decimal character is convenient and economical in practical use.

Beyond the adaptation of the metric system to the economic transactions of the ordinary affairs of daily life, it has a claim to respectful consideration as being the language of science the world over, used in scientific investigation and understood by scientific men in every nation and clime. That its use unquestionably tends to accuracy and precision of thought and expression is not to be doubted. The simplicity of the system, or its "oneness," to use the word coined by Lord Kelvin, is one of its great merits. It has but one system for every kind of weight and measure, and the method of written expression is the one of ordinary numerical notation. The fundamental unit is the meter, and from that are derived by the simplest process not only measurements of extension, but of weight and capacity as well. The conversion of bulk to weight and weight to bulk requires but a knowledge of specific gravity. It has been claimed by some that the difficulty of changing from our present tables of weights and measures to the metric system would be enormous. Lord Kelvin once expressed his views on this subject in the following language:

"I believe that the difficulty of making the change has been enormously exaggerated. I believe that in a fortnight people would become so accustomed to the perfect simplicity and easy working under the metrical system that they will feel that instead of its being a labor to pass from one system to the other, it will be less than no labor—that is to say, it would be a very great saving of labor after the first day or two of beginning to use the metrical system." Mr. Siemens, the noted engineer, testifying as to its introduction into his works, says: "It was all a matter of about a fortnight or three weeks; then the people were accustomed to it and did not ask any more for the old measures, but asked for the new."

This is a matter of the greatest importance to the electrical fraternity. There is no doubt but that the adoption of such a system would have a material bearing on our export trade, and what industry is more interested in this important subject than the electrical industry?

* * *

Up Mont Blanc by Railway and Elevator.

Of recent years, or since the development of electricity for power purposes, many mountain railways have been built in seemingly inaccessible places. We refer especially to such lines as that of Burgenstock, near the Lake of Lucerne in Switzerland, which reaches a height of 2,600 feet in a distance of 2,700 feet, and to those at Strauserhorn, in the same locality, with grades ranging from 30 to 62 per cent. The construction of the Jungfrau railway is another, and perhaps the best example to be cited in this connection, for it is an engineering achievement which but a few years back would have been impossible of accomplishment. These difficult undertakings have been brought to a successful issue, or, as in the case of the Jungfrau railway, ultimately will be, principally by an extensive use of electrically operated machinery and by taking advantage of any suitable water power in the vicinity for generating electric current economically.

Of late a mountain railway scheme has been mentioned, however, which for daring far exceeds anything that has yet been attempted. A French engineer of Marseilles has suggested a plan which he considers feasible for reaching the top of Mont Blanc, the highest mountain in Europe, whose summit is nearly 16,000 feet above the level of the sea. The scheme as worked out by this French engineer contemplates the building of a rack railway from what is known as Les Houches, a station on the line of the Geneva-Chamouni Railway, to a plateau on the side of Mont Blanc at an altitude of 6,888 feet, from which point a fine view of the Arve valley may be obtained. The line would rise 3,488 feet in a distance of 5,886 feet, or have an average grade of about 60 per cent. The necessary electric power for operating the road would be obtained from a waterfall on the upper Arve. The next step would be the running of a tunnel into the side of the mountain, starting from the plateau on which the rack railway terminates. This tunnel would have a rise of but 600 feet in 18,864, and would terminate at a point 7,500 feet above sea level, directly under the summit. So far there would seem nothing impossible in the plan suggested, although its accomplishment would be a more or less difficult engineering feat and cost an immense sum of money.

The next step, however, is probably the boldest suggestion made for some time. This is the piercing of a vertical shaft from the point where the tunnel ends to the summit of the mountain. The highest portion of this tunnel would have an elevation of 7,500 feet, and as the elevation of the summit is 15,800 feet the shaft would have to be 8,300 feet in length, or almost 1.6 miles. Many very deep shafts have been sunk for mining and other purposes, but invariably in such cases the work has been prosecuted from above, whereas in this case the shaft, which would be 10 by 12 feet, would have to be excavated from below upward. To meet this condition the promoter is said to have devised what he terms a "rising chamber," made of steel plates and constructed in two stories, each of the latter being divided into two compartments separated by heavy steel doors. In the upper story would be located the drilling apparatus. To avoid lowering the chamber out of the way of blasts, which would be impracticable and consume too much time, it is proposed to drill only on one side of the shaft at a time. Just before firing the blasts the drilling machinery would be moved to the neighboring chamber and the steel door closed to protect the inmates and machinery from pieces of flying rock. To catch the latter there would be a series of gratings placed at an angle of about 45 degrees and protected by fascines of brushwood. The rock thus collected would be transferred to the lower story, where it would be passed through suitable machinery, pulverized, and dropped down a 12-inch tube to the bottom of a shaft. Here a stream of water propelled by centrifugal pumps would carry it to the outer end of the tunnel. As the work progressed the chamber would be raised by means of steel racks placed in the four corners of the shaft. When completed the elevator would be operated by electricity. The scheme is unquestionably well thought out, and there is not a doubt but what part of it at least is feasible, providing sufficient capital could be obtained. Whether a shaft over a mile and a half in length could be excavated working from the bottom up, and whether an elevator could be made to run in it successfully or profitably if ever completed is another question and one we have our doubts about.

Under the Searchlight.

Notes and Comments on Various Topics.

In speaking of the proposal to equip the Manhattan road of New York (the elevated railroad) with electricity, one of the directors is reported as saying that no contract was likely to be signed for some time to come. The company wants the best system that it can find, he said, and it will not care to hurry in the matter of letting a contract for $6,000,000 or $8,000,000. It was stated that when the directors did finally ask for bids only one division of the elevated road would be equipped, so that this may receive a fair trial before the motive power on the entire road is changed.

* * *

A San Francisco man is said to have recently invented what is termed a "healthshaker." The machine consists of a platform on which the subject stands and which is then rapidly made to oscillate by means of an electric motor. The motion is said to be excellent for the liver, and the inventor claims that ten minutes of such shaking is better than half an hour's work in the gymnasium. A course of such shaking might advantageously be taken as a preliminary to a sea voyage.

* * *

It may interest some of our readers to know that telegraph and telephone poles are now being manufactured out of paper. The pulp from which these poles are made has mixed with it borax, tallow and other ingredients. It is then run into a mold with a central core and comes out as a hollow tube of the proper diameter and length. Before being erected the poles are given a coat of paint or varnish which makes them waterproof and very durable. If so desired, they may also be made fireproof by being saturated with a solution of alum water.

* * *

The *Herald* reproduces from its European edition the following as an instance of German red tape: "Some days ago, says the *Oberschlesische Volkstimme*, a schoolboy in Gleitwitz went out to fly his kite. A few minutes after its ascent it catches on the wire of the electric fire alarm and remains hanging. This catastrophe is seen by a vigilant policeman, who at once makes a report in writing to the Police Commissioner. The latter peruses the report and forwards it to the Police Inspector. The Inspector forwards it to the Town Hall, whence it reaches the Fire Committee of the municipality. The latter orders the kite to be removed, and moves a resolution that the zealous policeman receive a reward of 25 pfennigs. A fireman reports in writing that the kite has been removed. The cashier of the municipality pays the policeman 25 pfennigs and takes a receipt for the amount. The director of the school receives an order to find the boy who flew the kite—the search occupies fourteen days—and reprimand him. The rector reports in writing that this has been done. The Fire Committee sends a long document to the School Committee, requesting them to order the district school inspector to draw attention in all the schools under his orders to the danger of flying kites near telegraph wires, and forbidding them to indulge in this amusement in the streets of the town."

* * *

Philadelphia is in the midst of her great Peace Jubilee, which began on Tuesday with a naval review in which several noted war vessels took part, will be continued on Wednesday by the rededication of Independence Hall and a civic parade, and conclude on Thursday with a military parade and reception to the general officers at the Academy of

Music. Extensive electric illumination will enable everybody to see how the Quaker City looks at night while in the throes of a three-day celebration.

* * *

A WRITER in an Eastbourne (Eng.) paper, who is apparently of the Rip Van Winkle tribe, waxes eloquent over the coming of the Electric Age, though he gives the usual warning against "raw haste, half-sister to delay," and such like. Finally, he bursts into meter—of a kind—concluding with the following inspiring couplet:

"And dull reactionaries should remember, ere too late,
The Electric Age is coming—*and they can't postpone the date!*"

The italics are his. "All this," says *London Lightning*, in explanation, "is because the town council of a flourishing watering-place have decided upon going through with an electric lighting scheme, some three years after the cautious British public has found out that it is profitable in all senses, and Heaven knows how long since America and Continental Europe have had cheap light, cheap telephones and cheap tramways to an extent undreamt of here until quite recently. Surely it would be more correct to say that the Electric Age has come, though Eastbourne is only just awaking to the fact."

* * *

THE following recently appeared in the New York *Sun*:

"Tell me this," said the man from Chicago to the New Yorker, "who pays for lighting your streets when it is done? Who is the man or corporation who holds the Columbus avenue job? I live just off that thoroughfare, not far from Central Park. One reason I ask is that I think an old friend of mine who died seven years ago has returned to business and secured a contract in New York.

"His name was Baldwin. He was a Colonel in the civil war. When Carter Harrison the elder was first elected Mayor he appointed Baldwin gas inspector, and as long as Carter was Mayor the Colonel had the job. He was a faithful servant. He used to do his own inspecting on horseback. Many a night he played the solitary horseman act in Chicago, riding all night to see that the streets were properly lighted or darkened as he desired. For there were times when it was quite as important to turn off the gas as it was to turn it on at other times. One of the Colonel's imperative orders was that no gas was to be burned in the street lamps when there was moonlight. If the moon came up after, say, 10 o'clock, the street 'glims' were to be doused, or whenever it came up, no matter what the hour might be. And when the moon was in its first quarter the lamp-lighters used to watch it until it went down and then they lighted up.

"There never was a man who had the phases of the moon down as fine as Col. Baldwin. Cloudy weather cut no figure with him. The clouds might be thick enough to plough in, but as long as Col. Baldwin knew the moon was up and attending to business the streets were kept dark. For, the Colonel used to say, the moonshine was liable to break through any minute. Chicago saved money under old Carter Harrison's administration out of the moon as she was run by Col. Baldwin.

"But if the Colonel has come back and has a contract in New York, he has reversed himself. I find when I go home in the morning, when the moon is at its brightest, that the arc lights in Columbus avenue are doing their best work. But when there is no moon, and particularly when the clouds are thick and black, nary an arc light, nor any other kind, can you find. If a New York man has the contract he doesn't understand his business. If there is any moonshine in his contract he ought to stand in with the moon the same as old Col. Baldwin did, in the interest of the treasury and for the benefit of the populace."

The Electric Light in the Bengal Mills.

Almost all the jute mills, says *Indian Engineering*, are now lighted with electric light, and the special inspector reports that, with two or three exceptions, mills that had previously opposed its introduction have since been compelled to give way by the necessity of competing with their neighbors and retaining their hands, who otherwise would be attracted by the slightly higher wages they could earn by longer work elsewhere. In the report for the year 1896 the opinion of Mr. Walsh was quoted to the effect that working for the longer hours made possible by the use of artificial light was in reality a doubtful advantage, in view of the discontent caused among the operatives, the deterioration in the work done, and the higher wages to be paid for overtime. The facts now reported would appear to conflict with the view then expressed.

Street Railways of Glasgow.

The section of the Glasgow Corporation street railways recently equipped for overhead traction was formally inaugurated on October 13. This line is about 2½ miles in length and extends from Mitchell street to Springburn, the power station being situated near the suburban terminus. The line is double tracked throughout, and has been equipped on the span-wire system for an experimental trial of electric traction, prior to decision as to adoption of the overhead trolley for the entire system of street railways in Glasgow.

Electrical Industry in Egypt.

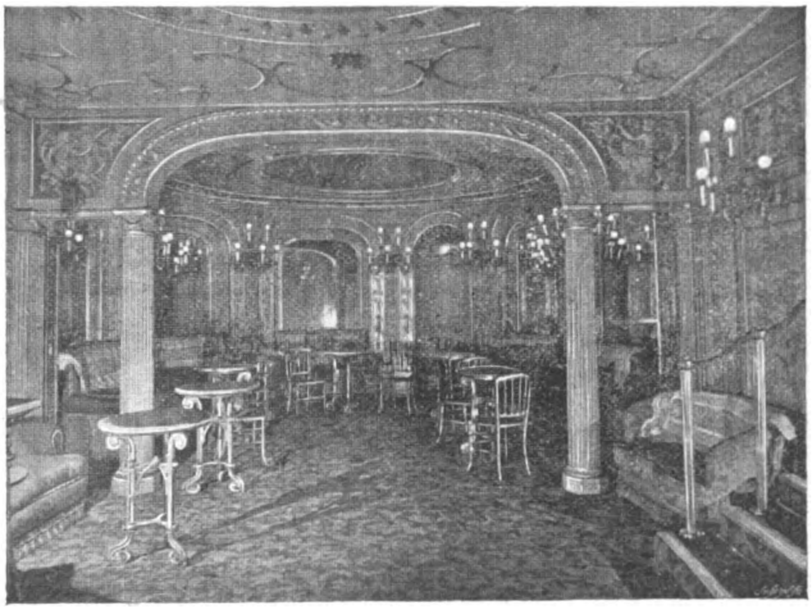
Considerable progress has been made during recent years in the electrical industry of Egypt. In Cairo electricity is used both for lighting and traction, as well as, of course, for transmission of messages. The Compagnie Centrale d'Eclairage par le Gaz have a monopoly for the supply of lighting and power in Cairo. Several private residences, however, together with public establishments, have private plants for electric lighting. For example, the palaces of the Khedive at Abdeen and Khoubbeh, Lord Cromer's residence, the Opera House, the Egyptian Railway Administration, several of the leading railways and Messrs. T. Cook & Son's Nile steamers. In Upper Egypt electricity is used in the sugar factories at Hawamdiyeh, Sheikh Fadl and Nag Hamadi. In Lower Egypt a large number of cotton factories are equipped with private electric generating plant, nearly a dozen districts having factories equipped in this way.

An Electrical Omnibus.

An electrical omnibus has lately been put in service experimentally in Berlin. According to a German contemporary, the 'bus has accommodation for twenty-six passengers, measures 23 ft. in length by 6½ ft. in width, while its weight, including the battery, is 6.65 metrical tons. The battery, which consists of 120 cells, contained in twenty-four boxes, weighs about 1¾ tons, and is stated to have a capacity sufficient to run the vehicle a distance of 60 kilometers (37½ miles) at a speed ranging from 6 to 12 kilometers per hour. The motor is geared to the front axle of the omnibus.

THE LIGHTING OF A THEATER.*

With the extension of public lighting mains into almost every part of London, it is not surprising to find that private plant for theaters and similar buildings is fast disappearing. There is much to be said against a theater operating its own lighting plant, but even in these days of public supply there is still something to be urged in its favor. To obtain a supply from the public mains means that it is not necessary to keep so large and so skilled a staff as would be necessary if a private plant were employed; no trouble from vibration is likely to occur in the theater or be transmitted to adjacent buildings, and there is under most circumstances probably less liability of a theater being plunged into darkness. On the other hand, a private plant, if skilfully operated, will supply current at infinitely lower rates than are offered by public companies, and lends itself better to those special stage effects that can be only created by the throwing on and off of large currents of electricity. This is especially valuable at times of rehearsal, when occasionally a heavy demand for current may arise. Moreover, it gives two strings to one's bow, for even with a private plant the usual practice is to be connected up to the street mains, and thus a prolonged and total extinction of light is less likely to occur than if a theater relied absolutely on the public mains.



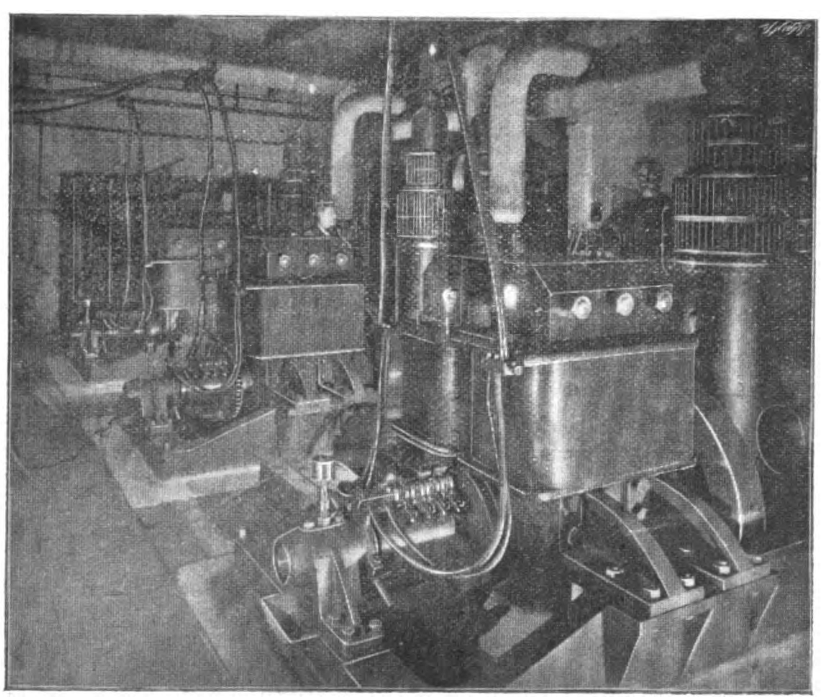
THE FOYER AT THE PALACE THEATER.

As we have suggested, most theaters nowadays rely on the public service for lighting, notwithstanding that some of them have to this day plant lying idle in their basements. Whatever reasons such places may have had for abandoning their private supply it is plain that they have not yet operated at the Palace Theater of Varieties, where a most complete system of private lighting is still in vogue. Structurally and decoratively we suppose this theater is still the finest in London, and everything harmonizes; the entertainment, the music and the lighting are among the remarkable features of what has been termed the most luxurious and the most comfortable building in Europe. So great is the confidence of the management in electricity that gas has been completely banished and there is not a single gas jet in the house; even the spirit lamps formerly employed at the bars for heating purposes have been replaced by electrical heaters.

We have recently made a detailed examination of the whole of the lighting plant that is employed here, and our experience is worth repeating. To start in logical order, it is necessary to make a descent—somewhat perilous to anybody but a sailor—

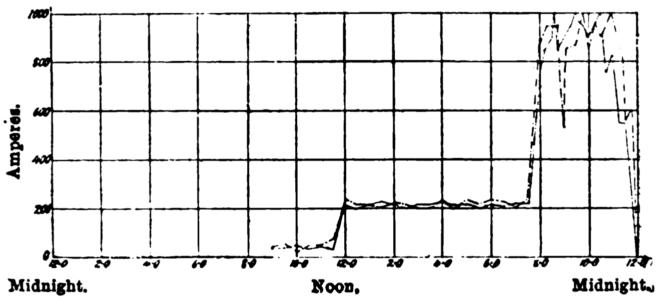
*From the *Electrical Review*, London.

to the engine and boiler rooms, which are some 24 feet below the level of the pavement. Here are installed, in a space that suggests some ingenuity in arrangement, three Marshall semi-portable locomotive boilers, which, at a steam pressure of 150 lbs., develop 80 horse-power. How to clean these boilers had been apparently a problem, for the back comes within 3 feet of the wall. Mr. W. Slade Olver, the chief engineer, surmounted the trouble in a somewhat ingenious manner, by having square holes cut in the wall immediately in the rear of the boilers, which gave access to a cellar, and the space thus provided enabled the stokers to operate their cleaning rods. There are not all the refinements in connection with the steam raising plant that one is accustomed to in central stations, and they would be obviously out of place; for instance, hand firing is considered good enough. There are, however, two Berryman feed-water heaters and vertical steam pumps made by the Deanes. Owing to the height of the building, the chimney shaft does not project more than 8 ft. above the roof, and, as a matter of fact, can be scarcely noticed at all. It is a point of some interest to observe that the water supply is obtained from sunk wells. The engine room is divided from the boilers by a party wall, and here are erected three Willans-Siemens sets. We have endeavored to give an idea of the engine room by means of photography, but, owing to the almost entire absence of daylight, artificial illumination had to be resorted to, hence the machines lack the distinctness that one usually obtains in central stations. The engines are of the single-acting central valve H H type, and the dynamos are of Siemens shunt-wound type, each giving 650 amperes at 110 volts. Beyond the paralleling switchboard, which is provided with the ordinary station voltmeter and ammeter, there is nothing more of importance in this room. The whole of the plant is, however, placed on a huge block of concrete, which is completely isolated from the side walls. Although such an arrangement of foundations has not in some places proved a bar to vibration, it is significant that at the Palace Theater no tremor whatever is observed in the interior of the building. On the roof faint pulsations can be observed occasionally, but then there is no one to complain of that. In any event, it would be a matter of extreme difficulty to communicate vibrations to surrounding property, for the theater itself is completely isolated from other buildings. In addition to the dynamos there is a battery of accumulators, consisting of 56 Epstein cells. The two halves of these are charged in parallel, four cells being utilized for hospital purposes. A battery regulating board is provided, furnished with the necessary devices.



ENGINE ROOM AT THE PALACE THEATER.

The mains from the engine room switchboard are carried to three main boards, two of which control the lighting in the auditorium, passages, stairs, vestibule, etc., and the third board controls the whole of the stage lighting. There are, therefore, three main circuits, called, respectively, A, B and C, the



TWO TYPICAL LOAD CURVES.

former one representing the stage circuits, the other two the front of the house. In accordance with the County Council regulation, the entrance and exit lights are arranged alternately on B and C circuits, so that in case of one circuit failing every other light would be still on.

In a sense the stage lighting is of the most importance, in so far as effects are concerned, and its proper regulation necessitates a somewhat elaborate board. Some alterations of the switching arrangements are in progress, and when completed the board will be probably one of the finest stage boards in London. The whole of the switching mechanism is placed at the right-hand side of the stage, at some distance from the ground, and from a special platform the footlights and the stage are controlled. The idea of the alternate circuits is carried out in the whole of the stage lighting. There are three sets of footlights arranged on alternate circuits, and the batten lights are connected in a similar manner. The lowering or dimming of the lights is a very important feature in the economy of stage management, and the alterations which are in progress include a set of liquid resistances. Up to the present, long lengths of platinoid wire have been utilized to give the necessary resistances, but these are now being done away with. The new scheme provides for a combined arrangement for dimming the entire front of the house; moreover, a new main break switch will put on circuits for stage effects, and it will be possible to produce sudden darkness in the house and stage together by interlocking through a bar any of the switches it is desired to operate. The ancient lime-light has been replaced by projector arc lamps, of which eight are in use, gas, as we have observed, being wholly tabooed throughout the building.

There are 10 arc lamps in front of the building, and the interior lighting consists of some 3,600 incandescent lamps, which are practically equivalent to 4,000 8-CPS. There are a number of ventilating motors fixed at different parts of the building, thus permitting the nicest regulation of the temperature of the building. Steam heating is used throughout the building, a system of live steam radiators being employed as well as a bank of radiators heated by the exhaust steam from the engine, fresh air being drawn from the street and blown into the theater by means of a Blackman fan.

As we have mentioned, the theater is connected to the supply mains; the total demand, however, which the company will meet is 2,000 amperes, and this can be turned on by means of change over switches, the amount of current per switch being 300 amperes.

It is hardly necessary to observe that electrical stage effects at the Palace are frequent. At the present moment there is the Biograph, which bids fair to rival Tennyson's brook, and there have been the wonderful series of living pictures, and latterly Zaeo and her electrical effects. As an indication of the demand for current that occasionally arises, it may be mentioned that one turn has required as much as 1,550 amperes.

A load curve cannot fail to be interesting, and some details as to cost will be useful. In 1897 the number of units generated was 234,798, coal and other fuel cost .59d., oil, waste, stores, etc., .11d., and wages .613., the total works' cost being 1.313d.

Electric Traction on Railways.

Improvements in train service, says P. Lanino in *Elettricità*, Milan, take the form of greater speed and more commodious carriages, the latter necessitating greater weight. Both of these require a more powerful locomotive; but, as the permanent way limits the size and weight of the locomotive, improvement ultimately consists in reduction of weight of the motor per HP.

The author considers that for steam locomotives the limit has now been reached, the best types developing 1,800 HP. and weighing 154 lbs. per HP. For progress, therefore, he looks to the electric motor fed from a central station, this being the lightest motor known; he believes that the weight can be reduced to 22 lbs. per HP., and that the absence of any reciprocating parts removes all limit to the ultimate speed attainable.

He describes the scheme of Davis and Williamson for an electric railway between New York and Philadelphia, to run at a speed of 187 miles per hour, and of Behr for a permanent way consisting of 5 rails supported on inverted V trestles. The latter, when tried at the Brussels Exhibition of last year, failed on account of the instability of the trestles.

Criticising the Heilmann locomotive, the author expresses his opinion that this will never prove superior to the ordinary steam one, as the great disadvantage of extra weight (220 lbs. per HP.) will outweigh the advantages of independent driving of each axle, triple expansion engines and greater regularity in the working of the engines. He believes that the present field of electric traction is that of local lines requiring frequent journeys and light trains, and cites as a successful example a three-mile trolley line opened at Baltimore in 1895. The locomotives weigh 90 tons, and have motors of a total power of 1,600 HP. distributed on six independent driving axles. The works' costs per ton mile, when 1, 2 or 3 locomotives are running, are, respectively, 0.186, 0.123 and 0.1015 pence. [The above is taken from *Science Abstracts*, London.]

THE ECKMÜHL LIGHTHOUSE.

France would seem to have been the first country to fully appreciate the advantages of electricity as a lighthouse illuminant. Until within the last ten or twelve years, mineral oil was used almost exclusively for lighthouse lamps, electricity previous to that time not being thought well adapted to this form of illumination, principally owing to a latent fear that through some accident to the generating machinery a lamp might become extinguished, which, as may readily be inferred, would have been a very serious matter. Another weighty reason which undoubtedly had considerable influence in causing the retention of oil lamps was the cost. When steam and electrical machinery are employed, skilled labor and frequent inspections are necessary, which materially adds to the operating expenses. As, however, electrical machinery was gradually improved upon, higher efficiency obtained and the cost of producing electric current proportionately reduced, according to a well thought-out plan France began the construction of a number of electric lighthouses along its coast, of which that of Eckmühl, embodying all the latest improvements, is the most recent and by far the most powerful. This new lighthouse, as may be seen by Fig. 1, is situated about one hundred yards back of the old lighthouse on a portion of the rocky shore of the Gulf de Moine in Brittany known as Penmarch Point. Work on this structure was begun in the fall of 1893, the expense of its construction being partly defrayed by a legacy of $60,000 to the French Government for this purpose by the Marquise de Bloqueville in memory of her father, Marshal Davout, Prince of Eckmühl. Thus does the lighthouse derive its name.

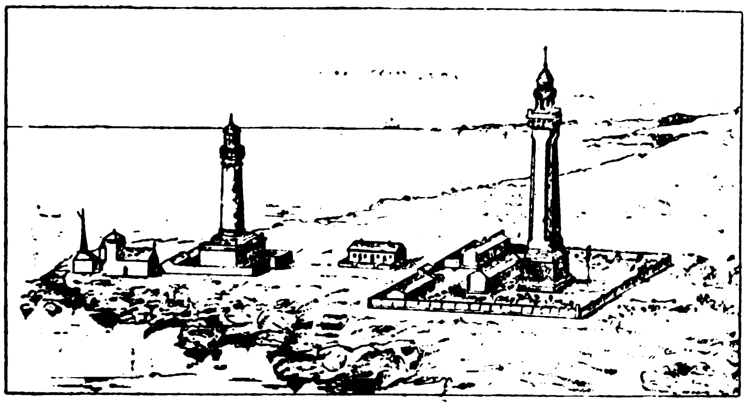


FIG. 1.

As is usual in France in the construction of most public works, special pains have been taken to give the lighthouse an attractive appearance from an architectural point of view, without however in any way detracting from its solidity or the purpose for which it was erected, and how well this has been accomplished may be gathered in a general way from Fig. 2. As may be seen by the illustration, a spiral stairway having 272 steps winds up in the interior. The total height of the tower above the ground is 206 feet, the plane of the light being about 209 feet 4 inches above high tide. At the foot of the tower and within an enclosure are situated several tastefully designed buildings containing steam boilers, engines, electrical machinery and other apparatus necessary in the operation of the lighthouse. The general arrangement of the engine and dynamo room may be seen in Fig. 3. The requisite amount of power for operating the fog-horn and lamps is obtained by means of two 12 HP. condensing engines. The latter are connected by means of belting to an overhead shaft which extends the whole length of the building. By means of this shaft the air compressor and alternators may all be driven at once, or if so desired the air compressor may be disconnected as well as one of the alternators, of which there are two. The latter generate two-phase currents which have been found to have several advantages over the ordinary alternating current for lighthouse use, notably in an increase in the steadiness of the light. It has moreover been found that by the use of dynamos generating two-phase currents, when the current of one lamp is for any reason cut off, the current passing to the other lamp does not increase more than one ampere in 25, whereas were the ordinary alternating current made use of this increase would be far greater. This peculiarity of two phase currents enables in the case of the Eckmühl lights of the carbons of one lamp being changed without extinguishing or causing the intensity of light in the second lamp to vary perceptibly.

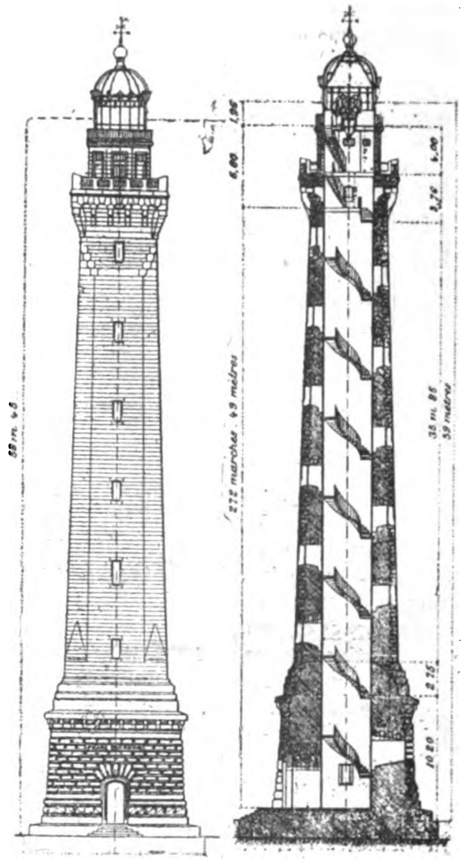


FIG. 2.

The alternators, as may be seen by Fig. 4, have eight poles, the intensity of their magnetic field being in the neighborhood of 4,000 C. G. S. units. Each is separately excited by means of a small direct-current machine fastened to the shaft as shown in the figure. The armature makes in the neighborhood of 810 revolutions a minute, and the resistance of each winding on the armature is .213 ohm. From tests that have been made it was found that the efficiency of these alternators varies between 70 and 75 per cent., depending on the speed at which they are driven.

The currents generated are of 25 and 50 amperes at a pressure of 45 volts. The air compressor, which is also driven by means of a belt from the main shaft, can be made to compress air to either four or fifteen atmospheres as desired. This compressed air passes to a small reservoir situated directly below the gallery on the upper part of the tower, where it is made use of during foggy weather for operating the sirene. The latter, located on the outside gallery of the tower, emits sounds of two similar tones (mi3) lasting three seconds and separated by an interval of similar duration, changing every ninety seconds to a uniform sound of the same tone also lasting three seconds. These sounds can be heard in clear weather from 7 to 8 miles. During time of heavy fog, however, the carrying capacity of the fog-horn is materially reduced, not exceeding under certain atmospheric conditions two miles.

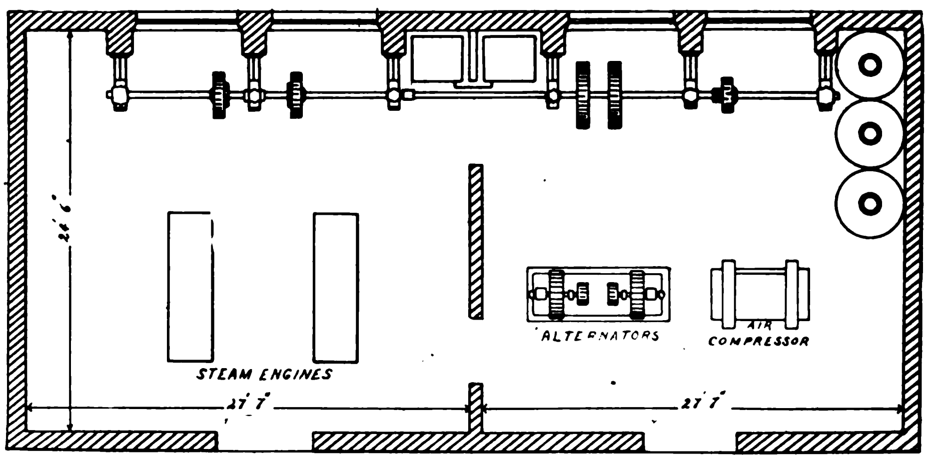


FIG. 3.

It is the lighting apparatus, however, wherein the Eckmühl lighthouse differs materially from any that has yet been built. This lighting apparatus, which is fifteen feet in diameter and almost twenty feet in height, is double; that is, there are two separate and distinct lanterns mounted one on each side of a common vertical shaft. An idea of the arrangement may be gathered by a glance at the cross section of the tower shown in Fig. 2. This novel arrangement was adopted at Eckmühl after careful investigation, as it was found that a far more powerful ray of light could be obtained with double lantern with less expenditure of energy, than in any other way. Each optical apparatus has four panels or windows composed of rims of prismatic glass so arranged as to disperse the light equally at all points in right lines; technically speaking, there are six dioptric elements and ten catadioptric elements. The whole illuminating apparatus, weighing over 4,000 lbs., is mounted upon a solid platform which is in turn connected to the vertical shaft previously referred to, being held upright by means of a circular drum resting in a trough of mercury. By this arrangement when the lights are revolved the frictional resistance is reduced to a minimum. The latter operation is accomplished in the way now in vogue in nearly all modern lighthouses, by means of a clockwork mechanism actuated by weights. It takes the Eckmühl lights twenty seconds to make one complete revolution, the flashes appearing every five seconds and lasting, as in all lighthouses along

the coasts of France, one tenth of a second. The reflection of these flashes may be seen, so it is claimed, under suitable atmospheric conditions, a distance of seventy miles. Carbons of 10 and 16 mm. diameter may be used in the lamps, which are both kept lit together. The intensity of the flash is regulated according to the condition of the atmosphere prevailing. On a very clear night, for instance, the 10 mm. carbons would be made use of, with but one alternator delivering 25 amperes of current at 45 volts to the lamps, whereas during heavy weather both alternators would be run, supplying 50 amperes of current at 45 volts to the 16 mm. carbons. The total number of hours a year during which the lamps have to be kept lighted is about 4 500, and during that period in the neighborhood 237,600 lbs. of carbon is consumed.

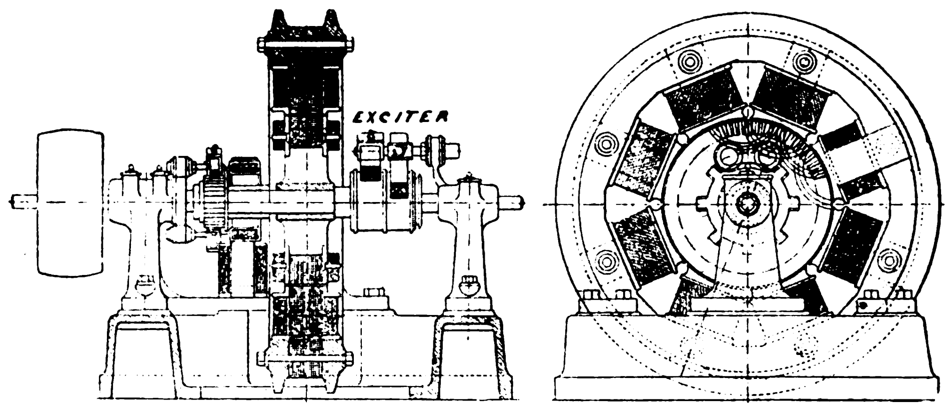


Fig. 4.

The illuminating power of the Eckmühl light is very great, greater in fact than any other lighthouse lamp in the world, with the possible exception of a light in this country designed by Mr. Henry Lapaute. Careful tests made with the Eckmühl lighting apparatus before it was permanently installed at Penmarch showed, at a distance of 650 yards, with 16 mm. carbons fed by a current of 50 amperes at a pressure of 45 volts, an intensity of light equivalent to 40,000,000 candle power. Besides the lights just described, two 12,000 candle power petroleum lamps are held in reserve to be used in the event of an accident happening to any part of the regular operating machinery.

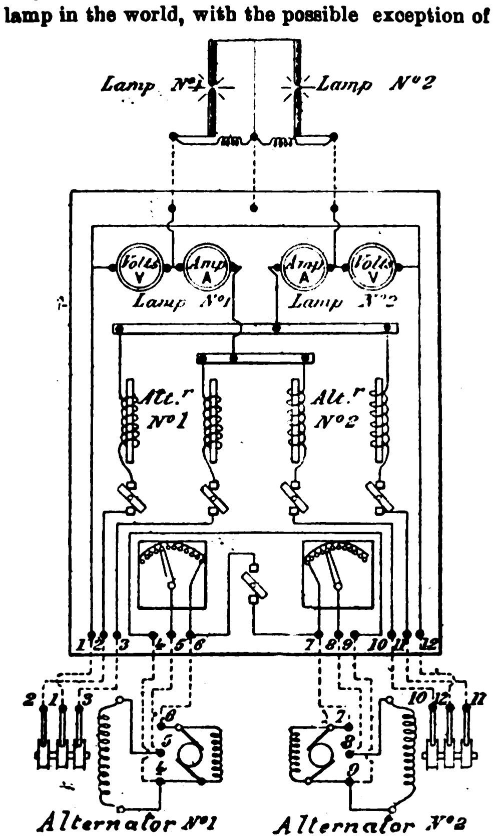


Fig. 5.

An excellent idea may be gotten of the general electrical installation at Eckmühl by an examination of Fig. 5. As will be seen, both a voltmeter and ammeter are placed in the circuit of each lamp, thus enabling the amount of current passing to either lamp to be determined at a glance.

The yearly operating expenses at Eckmühl are not nearly so great as might be expected, and far less than a similar lighthouse in this country could be kept in operation for the year round. Six men are constantly employed looking after the apparatus, whose salaries, with fuel and incidentals, make the yearly charges about $5,000. The total cost of erecting the lighthouse, as may already have been inferred, exceeded the legacy of $60,000 left for the purpose, the tower, buildings, machinery and optical apparatus having cost not less than $116,000.

[The above article, compiled principally from French sources, was specially prepared for ELECTRICITY. We are indebted to *L'Eclairage Electrique* for the illustrations.—ED.]

DIESEL'S RATIONAL HEAT MOTOR.*

BY E. D. MEIER.

All power which man uses, and all forces which he tries to curb and turn to his own purposes, have their origin in heat. Whether we spread the sails of a clipper to a spanking breeze, or urge an ocean greyhound at nearly railroad speed across the Atlantic ferry; whether we propel cars in the streets of Buffalo with electric force generated by the Niagara Cataract, or carry heavy packs on the backs of horses over frozen Klondike trails, we are using in some form the energy poured forth in lavish profusion by the central orb of our system. His heat causes the air currents which waft the ships to our shores; ages ago his rays called forth primeval forests, whose charred and compressed remains are fired under our steam boilers; vapors raised by his power from the waves of the ocean fall in life-giving rains on our continent, alike raising the level of the Great Lakes, whose waters feed the mighty cataract, and, in cooperation with his direct heat, calling forth bloom and fruit on the fertile fields whence man and brute nature alike derive their sustenance. Man, rising above the animal in his appreciation of the blessing of labor, first applied muscular force, and next what we are wont to designate as the natural forces, to assist him in his restless activity of production. Oars, levers, treadmills and all manner of harness for horse and steer preceded the use of wind or of falling water.

For centuries wind and water power were sufficient to drive all his machinery. The expansive force of steam, discovered by the ancient Egyptian, served but for a few simple actions, purposely enveloped in mystery to strengthen the superstition which priestcraft considered necessary for its schemes of government.

Even war, the delight, the pastime and the sole means of support of kings and nobles through many centuries, was slow in finding its most powerful agent in the explosive force of suddenly liberated heat. Finally, it was late in the seventeenth century that attempts were first made to utilize the expansive force of steam or of gunpowder in pumping water and for other useful purposes. And then, after the first experiments had demonstrated the tremendous force contained in these agents, these phenomena for a full century were of interest only to philosophers; and when Watt finally succeeded in harnessing the power of steam and making it work his will, inventors were already busy with engines designed to produce motive power by the explosion of gas or vapors.

Through all these centuries the forces employed were recognized by their effects, and no one suspected that the primal cause of all was the power of heat. Or, if we see in the early worship of the sun as the great life-giver some dim appreciation of this great physical fact, it had never yet risen to the height of faith or knowledge, nor had any one dared to attempt to measure and weigh heat in units of force.

The first heat motor which became a practical success—the steam engine—was for many years developed simply by gradual improvement of its mechanical appliances without any appreciation of the fact that heat economy was the primal consideration. It was, perhaps, well that this was so. Had the early inventors and designers of steam engines understood the limitations to which the steam engine is subject they would hardly have attempted to develop a machine which, after 100 years of experiment and another century of practice by the master minds of each generation, returns in work less than one-seventh of the potential energy residing in the fuel with which it is fed. And had they turned their attention to machines aiming at more direct transmutation of heat into work, the mechanical difficulties which would have confronted them might have retarded the industrial progress of the world by a full century; for, with all its defects as a vehicle of heat energy, steam has at least the one advantage that it can be used at very low pressures. The early engines gave results which for the time were of sufficient and even great value with pressures of less than 10 pounds to the square inch. Materials for higher pressures and temperatures were not available. These materials themselves had to be produced in larger variety and of better quality so that gradual increase in the pressure carried should give us as gradual an increase in fuel economy.

If the early inventors of internal-combustion motors were proceeding on more rational lines, so far as the final outcome was concerned they were kept back, and in many instances their efforts were foiled altogether by physical difficulties which required greater knowledge of metallurgy and greater mechanical skill than the world then possessed. For a full century the steam engine dominated the whole industrial field, and until twenty years ago it stood without a rival.

To an American engineer, Benj. Thompson, also known as Count Rumford, the world owes the first attempt to find an equivalent of heat in work, and the discovery that heat is not matter, but a form of energy. This important fact was communicated by Thompson, then residing in Munich, Bavaria, to the British Association for the Advancement of Science, just 100 years ago. Other experimenters followed, but it was not until much later that Joule, in England, and Mayer, in Germany, determined and fixed the mechanical equivalent of heat. Early in this century, Sadi Carnot, in France, developed the theory of a perfect heat engine, yet it was a long time before the clear reasoning of these men, though enthusiastically received and elaborated by Rankine, Zeuner, our own Thurston and others, found its way into the designing room of engine builders. For a long time the steam engine was studied only in its mechanical aspects, and the striking success of Corliss, while a great stride toward mechanical per-

*From the Journal of the Franklin Institute for October.

fection, tended rather to retard than to accelerate the study of the steam engine as a heat engine. It is still within the memory of most practising engineers of to-day that Hirn, by his wonderful series of experiments at Mulhouse, and his beautiful analysis of the results, aroused mechanical engineers to the importance of considering the utilization and conservation of heat in the steam engine as the fundamental question of design.

Naturally enough, then, when steam was once recognized, not as the cause but merely as the vehicle of the energy to be transformed into mechanical work, interest was revived in other heat motors. The experimental work of the beginning of the century was looked up, and the means and methods of the earlier inventors of engines, employing gas or oil vapors, were examined by many scientific and skillful engineers, who believed that there must be a more direct way of converting heat into work than the one through furnaces, boilers, and a long line of steam piping to the cylinder, where the conversion takes place.

Isherwood's conclusive experiment in regard to the waste resulting from the physical properties of steam had their due influence. Higher temperatures were sought, resulting in higher pressures, reheating and in increasing the number of cylinders. From the 4 to 8 pounds pressure of the earlier days, which could be contained in wooden boilers, such as some of you may remember to have seen in the water works in the city of Philadelphia, we have advanced to the 200 pounds and more carried by the great marine boilers of our ocean greyhounds and cruisers, and engineering schools possess experimental engines intended to determine the practicability of going up to 300 and even 500 pounds to the square inch. The vast industrial development brought about by the steam engine has given us metals, methods and data which enable us to contemplate such pressures with equanimity, and have developed lubricants capable of withstanding temperatures which ten years ago were prohibitory.

A little more than a year ago, Prof. Thurston published a scholarly discussion of the "Promise and Potency of High-Pressure Steam." His data were compiled from a number of careful tests on the triple and quadruple expansion engines of Sibley College, engines specially designed and admirably handled with a view of determining the possibilities and limits of progress in that direction. He concluded as follows:

"With equally excellent design, construction and management, we may expect the efficiency of the steam engine, with increasing pressures, to increase nearly as the logarithm of the boiler pressure.

"Gain in economy by increasing pressures simply must be expected to be slow and to steadily decrease in rate of gain as pressures rise, making the practicable, commercial limit a pressure comparatively low.

"The directions in which to seek for gain are the reduction of internal wastes and the production of a superheated steam engine."

According to this, if we can count in practice on 12 per cent. absolute efficiency with steam at 200 pounds, 14.2 per cent. would be the outside limit at 500 pounds, and 15.6 per cent. at 1,000 pounds steam pressures.

And in this reasoning the increasing difficulties of steam production and boiler economy at the higher pressures have not been considered. As he elsewhere finds cylinder condensation to account for from 18 to 34 per cent. of the total steam expended, the use of some more reliable vehicle for the heat than steam becomes imperative. Thurston's critical examination of the future prospects of the steam engine then points the way to the production and direct application of the heat at the very point where its energy is to be translated into work.

Thus, after an exhaustive analysis of experiments made with special steam engines of a higher and more developed type than are as yet to be found in practice, he arrives at definite conclusions which confirm and fix in exact limits the prophecies of men like Zeuner, Rankine and a host of others who have given eloquent testimony to the fact that the steam engine is wrong in principle. Thirty years ago Redtenbacher wrote to Zeuner that "the principle of steam generation and utilization is wrong; it is to be hoped that at a time not far distant the steam engine will disappear after we have acquired clear ideas on the nature and effects of heat."

All these utterances of men of genius naturally led to a renewal of interest in the internal combustion engine. Ericsson's brilliant failure in his attempt to substitute air for steam, and the final relegation of the hot-air engine to very small domestic pumping plants, seemed to put air out of the question as the vehicle for the heat.

The internal-combustion engine, experimentally developed by Barnett, in England, Drake, in America, and Lenoir, in France, improved by Brayton, Barsanti and others, and ably discussed and advocated by Dr. Siemens, became a practical motor in the hands of Otto in 1876. Otto's master patent, at first attacked as being but an adaptation of Beau de Rochas' theories, was sustained in the leading patent offices of the world, and became the foundation on which men like Priestman, Crossley, Atkinson, Capitaine, Clerk and others too numerous to mention, developed infinite varieties of type with a gradual and satisfactory increase in economy.

But they all worked in more or less beaten paths. The value of compression of the charge before explosion was recognized as increasing the initial pressure in the working cylinder. Means and methods for producing retarded combustion (the Nachbrennen of the Germans), or of slowing down the explosive action, were proposed and criticised with equal acumen and quite an expenditure of thermal units on the part of the disputants. Some of the mechanical devices evolved reflect the greatest credit on the skill and persistence of their inventors. But no one attempted a vital change in the cycle itself until Diesel appeared in the lists. Untrammeled by any previous experience in gas or oil engine construction, he was intent only on giving the clear and beautiful ideal of Carnot practicable and tangible form in a working engine. He experimented with various vapors more permanent than steam, until the very mishaps and difficulties encountered brought him face to face with the fact that the atmosphere about us could furnish a cheap, endless supply of a permanent gas, available not only as the vehicle of the heat, but as the means of evolving it from the fuel employed.

Rudolf Diesel is a Bavarian, forty years old. He received his early education in Paris, where his parents then resided, until they were forced to emigrate, in 1870, by the decree of the moribund Empire. He is a man of strictly temperate habits, a good mathematician and thoroughly versed in the science of thermo-dynamics, which he has made his life study. As a student at Munich he was a pupil of the celebrated Prof. Linde, now well known as the inventor and builder of the excellent ice machine which bears his name. Since the publication of his lecture of June 16, 1897, he has been fairly overwhelmed with praise and congratulations by the leading professionals of Europe. Perhaps no better gauge of the strong common sense and real greatness of the man can be found than the fact that all this praise and adulation has not turned his head in the least. He remains the same simple, earnest, conscientious student that he was before his great invention dazzled the experts in his line of engineering.

I was particularly struck with the simplicity, and I might almost say humility, with which he spoke of his great achievements. He considers his present success only as an incentive and a stepping stone to further work and progress. He is very accurate in all his statements, and thoroughly honest. Nothing can induce him to confound even his most sanguine hopes with a promise of any future success. He patiently and good-humoredly answered all my questions, and was instantly ready to show me authorities for his statements from the carefully chosen books of his extensive library.

As an engineer, he is more theoretical than practical, but has now at his command some of the best practical talent of Germany. Professionally well equipped and clear in his ideas, he is so simple and amiable in his manner that it is a pleasure to work with him, and these characteristics of the man promise to make the working together of the various interests in the many countries in which he has issued licenses satisfactory and beneficial to all, and will make a rapid progress in the practical development of the invention possible.

Mr. Diesel has been at work on the theories on which this motor works ever since he was a student at the Munich Polytechnic School. For the past fifteen years he has devoted himself almost entirely to this work. He even built a small experimental motor in Paris many years ago, the working of which enabled him to modify his first theories considerably. He, however, took the precaution to have the parts of this motor constructed in different shops to prevent his ideas and processes from becoming known. In 1892 he made his applications for his first patent in different countries.

In 1893, then residing in Berlin, he published a book on a new motor, which was translated in 1894 into English by Mr. Bryan Donkin, M. Inst. C. E., under the title "Theory and Construction of a Rational Heat Motor." In this little book Mr. Diesel developed an entirely new idea. It was this: To begin the work of combustion by first compressing atmospheric air to a point where its heat would become sufficient for ignition, and then gradually forcing into this compressed air a small quantity of pulverized fuel. This whole work was to be done in the cylinder of the motor, so that no heat would be brought into it from without. Mr. Diesel not only developed the theory, but suggested the leading principles of construction. At the time this book hardly went further than into the libraries and studies of men specially interested in the theory of thermo-dynamics. But Mr. Buz, of Augsburg, the general manager of the great machine works there, placed means and men at the disposal of Mr. Diesel to enable him to work out his theory in practice, and a 12 horse-power motor was built there on which many experiments were made. The improvements suggested were embodied in a second machine of the same size, and from this was evolved the 20 horse-power motor which established the working type now adopted. Mr. Fr. Krupp, of Essen, the German Steel King, also became interested in the matter. Mr. Diesel moved to Munich so as to be able to give his whole time to this work.

In the meantime, in 1895, a Mr. Schmidt, of Cassel, worked out and exhibited a steam engine working with highly superheated steam. For the time this motor attracted the attention of the engineering world; its defects were, however, so apparent that it did not come into general use, but it did serve to withdraw attention from Diesel and his work. On the 16th of June, 1897, Mr. Diesel delivered a lecture before the National Society of German Engineers at Cassel, in which he not only developed his theories, but exhibited in drawings the actual construction of his motor, and gave some data in regard to practical results obtained at Augsburg. Prof. M. Schroeter followed Diesel in further development of the theory of the motor, and gave in detail the results of tests made by him on the first experimental motor, and stated his conviction that the motor was now ready for commercial work. (These essays were published in the *Zeitschrift des Vereins Deutscher Ingenieure* of July 10th, 17th and 24th, 1897.)

At the conclusion of these papers a wave of en-

thusiasm swept over the large audience of professional engineers, and the desire naturally arose to see the motor at work. Mr. Diesel extended invitations to all engineers and manufacturers to visit the works at Augsburg and examine and test the motor for themselves. This invitation has been so generally accepted that for the next nine months the motor was practically on exhibit for every hour of the day, under the closest inspection by engineers, not only from Germany, but from every civilized country. It was therefore necessary to keep it running as a petroleum motor, and not until a month ago was it possible to dismantle the engine in order to make the slight but important changes necessary to adapt it to experimental work on gas.

Mr. Diesel's idea was to follow Carnot's cycle strictly, obtaining the lower isothermal and adiabatic curves by compression and the upper ones by combustion and expansion. For a long time he experimented with various vapors which, under normal conditions, are far above their point of condensation.

Ammonia vapors, especially, seem to have the properties best suited to the theoretical process. But great difficulties in handling them were encountered in practice. In the endeavor to replace them he was naturally led to experiment with air. Up to this time he had necessarily applied his heat from without and was subjected to the losses and limitations due to the metal walls through which it had to pass. He was then subject to the same losses which had defeated Ericsson, and was compelled to make the step which made his motor an internal-combustion engine. Starting out, then, with the intention of improving the caloric process of the steam engine, he reached, in a round-about way, means similar to those employed in gas and oil engines. But this similarity is strictly limited to the *fact* of internal combustion, the *method* of combustion being radically different. Further, finding that to begin his compression isothermally led him into pressures which must, in our present practice, be considered excessive, he abandoned that part of the Carnot cycle and made his compression adiabatic throughout, thus reducing the necessary pressures from over 100 atmospheres to between 30 and 40. When, as in the history of the steam engine, these higher pressures become practically feasible, a return to the original complete process may become advisable. Mr. Diesel's fundamental invention is then really a process for converting heat into work; this, of course, has been supplemented by other inventions naturally growing out of the persistent and logical development of a practical machine to operate on this process. I am happy to have available the description and opinion of no less an authority than Lord Kelvin, written by him after a careful investigation of Diesel's claims, and I will quote it in full.

"The invention may be defined as follows, (*a*) — (*h*):

"(*a*) Use a quantity of air very large in comparison with the quantity of fuel and which may be much larger than is required for complete combustion of the fuel. This air, at the beginning of (*b*) is at atmospheric temperature T; and is at a pressure somewhat above atmospheric pressure in virtue of the operation (*h*) described below, unless this operation is omitted.

"(*b*) Compress this air adibatically to a temperature far above that required to ignite the fuel under pressure.

"(*c*) Immediately after the dense air thus heated has commenced to expand, inject into it the fuel, whether gaseous or liquid, or finely powdered solid, thus causing the fuel to burn as it enters and to prevent, by the heat so generated, the expanding air from going down in temperature.

"(*d*) Regulate and distribute through a prescribed portion of the working stroke of the working piston the admission (c) of the fuel.

"(*e*) Use a governor to alter the duration and amount of the combustion (*c*) according to varying requirements of varying circumstances.

"(*f*) After the introduction of the fuel ceases, continue the expansion until the air is cooled sufficiently, nearly down to the atmospheric temperature (without any abstraction of heat by a water jacket). It becomes cooled to exactly the atmospheric temperature when it sinks to the atmospheric pressure, provided the concluding operation (*h*) of the cycle is properly adjusted, according to the extent of the operations (*b*) (*c*) (*d*) (*f*).

"(*g*) Reject the whole or part of this air from the machine, and take in fresh atmospheric air instead to make up the whole quantity with which we commenced in (*a*).

"(*h*) Keep now this air at atmospheric temperature by injected water, and compress it to such a pressure as shall cause the fulfillment of the condition stated at the end of paragraph (*f*). This operation may be advantageously omitted, with some sacrifice of theoretical thermo-dynamic economy, but probably with practical advantage, in smaller types of engine.

"If regulation (*d*) of operation (*c*) were so conducted as to keep the temperature at an absolutely constant degree (S) during the portion of the working stroke to which it refers, the series of five operations (*b*) (*c*) (*f*) (*g*) (*h*) would constitute an absolutely perfect Carnot cycle for the production of mechanical effect from a quantity of heat given at the temperature S, with T as the lowest temperature available for carrying off waste heat. The conditions, of course, cannot be *perfectly* realized in any real machine; but Diesel has shown how to make a good, practical approximation to their fulfillment, whether the fuel be gas, powdered solid or oil. He has already, with oil as fuel, realized this approximation with exceedingly good practical results, and has actually obtained 58 per cent. more work than any that has been given, from the same weight of oil, by any of the best oil motors previously made.

"The best economy of oil motors recorded in 'The Gas and Oil Engine,' by Clerk (Longmans & Co., 1896), is 371 grams of oil per BHP. hour, and the Augsburg tests of the Diesel engine give 234 grams of oil per BHP. hour.

"Besides this great advance in economy of fuel, Diesel's invention has given many collateral advantages of much practical importance. By supplying the fuel gradually to hot expanding air during a determined part of the working stroke of the main piston, and by using a much larger quantity of air than that required for complete combustion, he keeps the highest temperature reached by his engine several hundred degrees centigrade lower than the temperature essentially reached in the working cylinders of previous gas and oil engines. And the expansion after the end of the combustion gives a much lower temperature of exhaust without cooling by water jacket, than both expansion and water jacket together give in other gas and oil engines.

"Diesel's process of heating the air, simply by compression, to a temperature far above the igniting point of the fuel, before the fuel is introduced to it, supersedes all use of flame or hot chamber for ignition, even when the engine, cold in every part, is started for its first stroke by energy stored in a compressed air vessel from its previous working. This capability for instant starting from cold, and for stopping and starting again with perfect readiness at any time, is, I believe, a very valuable item of superiority, for many practical purposes, over any gas or oil or other interior-combustion engine previously made. Diesel's invention of introducing the fuel into air previously heated to far above the igniting point, merely by compression, and so causing the fuel to ignite, is, in my opinion, thoroughly original, and it has not been anticipated by any previous inventor. In nearly all previous gas and oil engines the air and fuel are compressed after being mixed together, with the great disadvantage that the degree of compression cannot go beyond comparatively narrow limits without causing explosion before the compression has ceased. In Barnett's third engine, the air and gas are compressed in separate pumps which, after the compression, discharge their contents into the motor cylinder. There they are ignited by means of a flame controlled by an igniting valve invented by Barnett (being almost identical in principle with the igniting arrangements used by many subsequent inventors). But neither Barnett nor any subsequent inventor anticipated Diesel in causing the fuel to be ignited by the high temperature produced by previous compression of the air into which it is introduced.

"Diesel is also quite original, and is, I believe, not anticipated by any previous inventor, in gradually introducing the fuel into expanding air, and so regulating and controlling the temperature produced by the combustion."

(*To be continued.*)

MODERN TRANSFORMERS.*

BY W. G. RHODES, M. SC.

One of the most important considerations in the construction and organization of an alternating current installation is the choice of suitable transformers. Upon such a choice depends to a great extent the efficiency of the whole plant and the regulation of pressure on the consumers' premises. If the light load losses in a transformer are not kept as low as possible, the all-day efficiency is seriously affected; if the secondary resistance is too high, and if there is appreciable magnetic leakage, the regulation may be so bad as to breed dissatisfaction amongst the consumers and consequent loss of custom. On this account it is not only advisable to have transformers possessing all the most modern improvements, but also to employ as few as possible consistent with the requirements of the area to be fed. It is, in fact, economical to replace large numbers of old type transformers by a few modern transformers having the same or greater aggregate capacity. This is well illustrated by the following cases:

In a town in Massachusetts having a population of 50,000, an alternating current station was constructed a few years ago, and 57 small transformers, having a total light capacity of 1,499 lights, were installed. Quite recently these have been replaced by 18 modern transformers capable of supplying 1,624 lights. The total core loss of the old transformers was 5,866 watts; that of the new, only 1,348. This difference in losses gives a yearly saving of 39,578 kilowatt-hours, which may be valued at about £132. Thus neglecting all the advantages except the diminution of core losses, the cost of the change will be met in 1 year and 9 months. The light capacity of the plant is increased 9 per cent., while the total core loss is decreased by 77.5 per cent. Further, on account of the decreased core loss, 4,518 additional watts are available for sale, producing an additional income of £169 at the present rate.

In another case 40 new type transformers replaced 53 old ones. The total capacity of the old ones was 1,135 lights, of the new 1,070. The core loss of the old transformers was 4,845 watts, and of the new 1,343 watts. This gives an annual saving of 30,678 kilowatt-hours, which will cover the expense of the change in 2 years and 9 months.

As regards regulation, we cannot too strongly urge the necessity of keeping it under full control. It is not necessary to point out how injurious to incandescent lamps is undue variation of voltage. If lamps are over-run, their life is considerably shortened, and frequent renewals are the inevitable consequence. This together with the bad light which results is bound to beget the distrust and disgust of the consumer. It is a fact frequently not realized

*From the *Electrical Review*, London.

that a change of 1 per cent. in the voltage causes a change of 7 per cent. in the candle-power of an incandescent lamp. A variation of 4 per cent. on either side of the normal voltage, that is a total variation of 8 per cent., means over 50 per cent. change in the candle-power. It is a lamentable fact that such changes are only too frequent in alternating current plants, and it is more than probable that this is the chief reason why so many alternating current stations fail to produce a dividend.

Why should this bad regulation occur? It is not because alternating currents are not as capable as direct currents of feeding any given area. It is because the management of alternating currents is not sufficiently well understood, and their application is not manipulated with sufficient skill. The phenomena of alternating currents are much more difficult to understand than those of direct currents, and no one is competent to undertake the management of an alternating supply station whose acquaintance with the subject is entirely of a practical nature.

I do not wish to depreciate practical experience, far from it, but I do wish to emphasize the necessity of sound theoretical training as well. A manager of an alternating supply station ought to understand thoroughly the cause of the bad regulation and to fully appreciate the various remedies. Bad regulation may be due to poor transformers, to large wattless currents caused by motors, etc., and to various other causes. Each cause has its remedy, and if the proper one is applied good regulation will result. Theoretical training enables us to determine the causes and their remedies; practical experience tells how best to apply the remedy.

I may safely say that the question of regulation is the most important of all to the supply company. What is more aggravating and annoying to the consumer than to have his 8 CP. lamps sometimes giving fully 12 CP., and at other times barely 3 or 4 CP., sometimes less than this? Yet such is the case with many alternating current stations. The result is, the consumers return to gas as being more reliable, the electric company loses its custom, or at any rate does not increase it. The electric supply committee grumbles because the plant does not pay, and the blame is laid on the alternating current. This is nonsense, sheer nonsense. The alternating current is all right if it is properly managed. It is the application and management which is at fault. The real reason why direct current are usually a greater financial success than alternating current stations is because the application and management is simpler and the regulation is more reliable. Make the regulation of an alternating plant equally good and the financial success will be greater, because often the losses in a direct current supply are greater than in an alternating current one. If potential wires are led from the centers of distribution to the generating station to give indications of the rise or fall of pressure, a competent man should be able to make an alternating current plant quite as reliable as is possible with continuous currents. Frequently it is an impossibility to attain the necessary high efficiency with continuous currents, and, having installed an alternating current plant, it is an admission of incompetency to allow it to be a failure.

An electric railway worked on the three-phase system will shortly be opened between Stansstad and Engelberg in Switzerland, so we are informed. The length of the line is about 11 miles, and part of it has a gradient of 25 per cent. on which the rack and pinion system will be used. The power will be derived from Obermatt, where a contemporary states a fall of 1,250 ft. will be utilized.

Now is the time to send in your subscriptions for "Electricity," the brightest, wittiest, best read, most widely quoted and popular paper in the trade.

SOCIETY NEWS.

Meeting of the American Institute of Electrical Engineers.

The 128th meeting of the Institute will be held at 12 West 31st street, New York City, this (Wednesday) evening, October 26, at 8 o'clock.

A paper will be presented by A. A. Knudson, of New York City, on "An Electrical Survey in the Borough of Manhattan, New York City," showing results of stray current measurements between electric railways, underground pipes, etc., also results of tests on the Brooklyn Bridge.

Applications have been received from the following candidates for associate membership which will be acted upon by council at its meeting November 23:

Howard Wallace Leitch, Brooklyn, N. Y.
John Cassidy, Honolulu, H. I.
C. Stowe Reno, Cincinnati, O.
James F. Cosgrove, Scranton, Pa.
James Wilkinson, Birmingham, Ala.
R. H. Sperling, Victoria, B. C.
James Hamilton, Boston Mass.
Bernard Hoffman, New York City.
Donald H. Fay, San Francisco, Cal.
S. L. G. Knox, Montclair, N. J.
A. Wilford Zohm, Minneapolis, Minn.
Cleveland Abbe, Washington, D. C.
Harvey D. James, Yonkers, N. Y.

A meeting of the Executive Committee will be held at 26 Cortlandt street, New York, this (Wednesday) afternoon at 4 o'clock.

Members who desire to present papers during the season are requested to communicate with Mr. Herbert Laws Webb, 15 Dey street, New York, chairman of the Committee on Papers and Meetings, or with the Secretary, Mr. Ralph W. Pope.

Meeting of the New York Electrical Society.

The 190th meeting of the New York Electrical Society will be held at the Pearl Street sub-station, Brooklyn, of the Edison Electric Illuminating Company of that city on Thursday, October 27, at 7:30 P. M. After an address on the company's work by Mr. W. S. Barstow, chief engineer, a brief inspection of the station will be made. The rest of the evening will be devoted to a flying visit to the sub-station "A" (formerly the Citizens' Station) and the big Union Central Station at Bay Ridge. Special parlor cars will be ready to take the visitors from the Pearl Street Station, and on the return trip from Bay Ridge a collation will be served on the trolley train.

In returning, for the convenience of the New York members, the Brooklyn Heights Railway Company has kindly arranged to run the parlor cars to the New York end of the Brooklyn Bridge.

Personal.

Mr. M. Cokeley, who is probably known to many of our readers, has been made superintendent of the works of the C. W. Hunt Company, Staten Island, N. Y., assuming the duties of that position October 14 after several months' work revising the factory system.

Large concerns are beginning to relieve the office management of the providing for the details in office routine, the installation of systems, methods, etc. This work properly belongs to a specialist, one who, constantly keeping his eyes open for improvement, studying the best literature on the subject and devoting his energy entirely to the work, becomes an expert. Mr. Cokeley has made this special work his profession for some time, being for many years with the General Electric Company and later with other prominent firms. His experience as a practical mechanic has been of great benefit in this line of work, enabling him to detect almost instantly the leaks that invariably exist and which are so destructive to profits.

CANADIAN NOTES.

The shareholders of the Montmorency Electric Power Company of Quebec have ratified the action of their directors in selling the property of the company to the Quebec, Montmorency & Charlevoix Railway Company. The shareholders of the former company not only receive for each $100 share of their stock in that company a share of an equal amount in the latter, but also a 20-year debenture of $100 bearing interest at 5 per cent. per annum.

The new Metropolitan Electric Company of Ottawa has purchased the Britannia water power at Britannia in the suburbs of Ottawa. The deal was completed last week, and the amount involved is said to be over $20,000. Mr. J. R. Booth, the millionaire lumberman, owned the water power, the capacity of which is estimated at about 40,000 horse-power, and he has given a guarantee to the Metropolitan Company that they could obtain 1,500 horse-power with an outlay of but $6,000.

The anchor ice trouble in the Ottawa river during the winter months will this season be overcome by the Ottawa Electric Railway Company by means of a large storage battery. The company has heretofore been troubled with anchor ice getting in the wheels at the power house. The power has been greatly lessened as a result, and occasionally the cars have been so short of power that they could not run. The new storage battery will act as an auxiliary and as a regulator.

Prof. V. L. Emerson's marvelous invention for the conversion of sawdust and sawmill refuse into commercial products was tested this week before a large gathering of the prominent lumbermen of the Ottawa district and of citizens, among whom were several members of the Dominion Government. Prof. Emerson says that the invention is a pre-eminent success. The machine gets its fuel from the gas obtained from the sawdust, so that the process is a continuous one. It runs automatically.

Annual Meeting of the Pennsylvania Street Railway Association.

The seventh annual meeting of the Pennsylvania Street Railway Association was held in the Board of Trade rooms at Scranton, Pa., on the 19th and 20th inst. Frank Silliman, Jr., general manager of the Scranton Railway Company, was chosen presiding officer in the absence of Robert F. Wright of Allentown. The proceedings were confined principally to an interchange of views.

Officers for the ensuing year were elected as follows: President, Frank Silliman, Jr.; first vice-president, William B. Given of Lancaster; second vice-president, Dallas Sanders of Girardville; secretary, S. P. Light of Lebanon; treasurer, W. H. Lanius of York.

Lancaster was selected for the next meeting.

On the evening of the 20th a banquet was given to the delegates by the Scranton Railway Company.

LEGAL NOTES

In the Hudson County (N. J.) Circuit Court on the 14th inst., Ida Schnaell and Louis Schnaell, her husband, of Union Hill, recovered a verdict of $15,000 damages against the North Hudson Railway Company. Mrs. Schnaell asserted that while alighting from one of the company's cars she was thrown to the street and severely injured by the sudden starting of the car. The jury gave her $10,000 and her husband $5,000 for the loss of her services.

A. L. Sailor and William M. Brown have been appointed receivers of the Braddock Electric Railway Company of Braddock, Pa. The receivers were asked for by Isaac M. Heidelberg and A. M. Sailor, officers of the company, and William M. Brown, an extensive bondholder. The bill states that the company is insolvent, the road not in operation and the equipment and assets are fast depreciating in value.

At San Francisco, Judge Seawell of the Superior Court has rendered an important decision dismissing

the application of the Board of Railroad Commissioners for a mandate to compel the Market Street Railway Company to produce its books for examination. The commission wished to fix a schedule of street car fares, but Judge Seawell holds that the term "railroad" in the statutes does not refer to street railways in the true meaning of the word, and that, although the commission is empowered to fix rates for carrying freight, the law does not imply the power to fix passenger rates, and that any other interpretation would involve the carrying of passengers and freight by coach and baggage companies. Judge Seawell holds that only municipal authorities have the power to fix the rates of street car lines. The case will be appealed to the Supreme Court.

THE NEWS.

What Is Going On In the Electrical World.

LIGHTING.

Auburn, N. Y.—It is said the D. M. Osborne Company is contemplating erecting an electric lighting plant to furnish light for its three big establishments in this city, and it is quite probable that the new plant will be constructed on a large enough scale to do a general lighting business.

Camden, N. J.—Proposals will be received at the city clerk's office until Wednesday evening, November 16, for lighting the streets of the city with arc and incandescent electric lights for the terms of one, three and five years, beginning July 1 next. Proposals should be marked "Electric Lighting" and addressed to Charles C. Southard, chairman.

Creede, Col.—This town has been in total darkness since the destruction of its electric light plant. It is proposed to build a larger plant and one that can furnish light all night.

Fostoria, O.—The City Heat & Light Company, besides purchasing the Fostoria Light & Power Company's plant and the lines of the Northwestern Ohio Natural Gas Company within the corporate limits, has purchased a well-located site for its power house and necessary buildings. All machinery will be of the latest and most improved types. The combined plants will cost $125,000.

Glencoe, Minn.—The local electric light company has been granted a ten-year franchise and has commenced work on the plant.

Grand Rapids, Mich.—The contract for the construction of the municipal lighting plant has finally been awarded to the Chase Construction Company of Chicago, concluding an agitation that has lasted about five years.

Harper's Ferry, W. Va.—The Harper's Ferry Light & Power Company has secured from the corporation board the right to establ sh an electric lighting plant here, and has been also given a contract to furnish arc and incandescent lights for town use.

Herkimer, N. Y.—The proposition to bond the village for $13,000 for the purpose of erecting an electric light plant was carried by a majority of 122 at the election held on the 14th inst.

Holly Beach, N. J.—The Seacoast Electric Light & Power Company's plant, which supplies the resorts of Wildwood and Holly Beach with light, has been sold at sheriff's sale to the mortgagee, Abraham Anderson, of Philadelphia, for $2,000.

Hutchinson, Minn.—H. A. Porter of Milwaukee is in this city to confer with a committee in regard to putting in an electric light plant.

Jonesville, Mich.—At a special election held here a few days ago to vote on bonding the town for $28,000 for electric lights and waterworks, the proposition was carried by a large majority.

Kokomo, Ind.—By order of the court the plant of the Citizens' Light & Power Company in this city will be sold at receiver's sale on November 12. The plant originally cost $70,000, and is the only commercial electric lighting plant in the city.

Lebanon, Pa.—Proposals will be received by the police committee of this city until November 7 for furnishing electric street lighting beginning June 1, 1899, to consist of 125 arc lights of 2,000 c.p. each. Proposals to be contingent upon a contract for five years, also for ten years, and price per lamp per year to be made accordingly.

Manheim, Pa.—In order to furnish the borough of Mt. Joy with electric lights, the Manheim Electric Light, Heat & Power Company will have to build a line across Rapho township from Manheim, a distance of seven miles. The company some time ago secured the franchise to furnish the light.

Malone, N. Y.—Superintendent of Banks F. D. Kilburn and S. F. Wright of Malone and J. H. Abbott of Gouverneur have made application to the board of trustees for permission to erect a new electric light plant here.

Miama, Fla.—It is understood that Mr. Flagler intends to establish an electric lighting system in this town at an early date.

Niles, Mich.—Considerable complaint is being made by citizens that the municipal electric light plant here is not self-sustaining, and it is becoming the general belief that the city made an injudicious investment or that gross mismanagement exists.

Schoolcraft, Mich.—Some time ago the proposition to bond the village for an electric lighting plant was voted down, but the subject is now being discussed anew and the council will before long be petitioned to call another election.

Somerville, Mass.—The aldermen have passed a resolution favoring the establishment of a municipal electric lighting plant by a vote of 6 to 2.

Wharton, Tex.—G. C. Gifford has purchased poles and machinery for the electric light plant and the work of construction will be begun at once.

Winchester, Va.—An incandescent electric light system is to be added to the arc light system now in use here. All the latest appliances in the way of electric machinery will be used, and it is expected that the new system will be in operation January 10 next.

Wooster, O.—The Wooster Electric Light Company has made a ten-year contract with the city to furnish eighty arc lights at $60 a light per annum.

STREET RAILWAYS.

Albany, N. Y.—The Board of Railroad Commissioners have authorized the Twenty-eighth and Twenty-ninth Street Cross-town Railway of New York City to change its motive power from horses to the underground system of electricity.

Cleveland, O.—Ordinances requiring the Cleveland Electric Railway Company to sell seven tickets for 25 cents on its Cedar avenue line and the Cleveland City Railway Company to make similar rates of fare on its Kinsman street line passed the city council on the 17th inst.

Columbus, O.—The Milford & Goshen Traction Company, incorporated here a few days ago, propose to run their road over the Wooster turnpike, paralleling the Little Miami Railroad as far as Milford, where it veers to the right. It will pass through Russells, Red Bank, Terrace Park, Plainville and several other towns. W. C. Compton, one of the incorporators, is the president of the Cincinnati, Columbus & Wooster Turnpike Company.

Detroit, Mich.—The "Tribune" states that on the 14th inst. C. H. Lawrence of the International Construction Company closed a contract for that company at Cincinnati to build an electric railway from Cincinnati to Hamilton, O., a distance of 25 miles, the contract price being $450,000. This line is independent of the Hamilton & Dayton line and has obtained consents over another route. When completed there will be two street car routes from Hamilton to Cincinnati.

Gallatin, Tenn.—A movement is on foot here to establish an electric car line from some nearby point on the Tennessee River to this city.

El Paso, Tex.—Capitalists at Fitchburg, Mass., have addressed parties here as to the probabilities of getting a franchise for an electric street railway in this city, and St. Louis men are also making investigations in the same direction, so that there is every likelihood that El Paso will have an up-to-date street railway before many months have passed. A franchise map showing the streets over which an electric line will be permitted to run has been drafted by a sub-committee of the citizens' general committee.

Montreal, Can.—An electric car of the Montreal Park & Island Railway Company which had been fitted with roller bearings was tested on the track a few days ago, and the system was pronounced very satisfactory by a number of railway men and experts who were present.

New Egypt, N. J.—Prominent citizens of this vicinity are talking of organizing a trolley company to run a line from Trenton via Allentown, New Egypt, Cassville and Lakewood to Point Pleasant. The places mentioned are only about eight or nine miles apart, covering a distance of about forty-five miles. Train service between this place and Trenton and Point Pleasant is very unsatisfactory, while there is no railroad at either Allentown or Cassville, both thriving villages.

New Rochelle, N. Y.—The "Pioneer" says: "The Huckleberry Electric Railroad officials announce that the new trolley road connecting the Pelham and Pelham Manor railroad stations and the double track connecting the old and new Boston Post Roads will be in operation by November 1. The company also expects to be running cars to the New Haven Railroad station at New Rochelle by the same time. So many promises have been made in New Rochelle by the trolley people that some of our citizens would not accept a statement under oath."

Niagara Falls, N. Y.—The Buffalo & Niagara Falls Electric Railroad Company has taken formal possession of the Buffalo, Kenmore & Tonawanda electric railroad, which it bought under foreclosure proceedings some time ago.

Pueblo, Col.—It is stated in the "Chieftain" that the Gold Belt line, at present about eight miles long, will be equipped with electricity as soon as the electric plant now building at Goldfield is completed, probably in February. Electricity on the road will entirely supplant steam as motive power. The total cost of the plant is $400,000.

Santiago de Cuba.—A franchise for an electric road from Santiago to El Caney has been granted by General Wood to prominent local business representatives. The road will be hailed as a boon by the people, but is hardly likely to pay more than expenses for a few years.

Stroudsburg, Pa.—Frank H. Smith, president of the Stroudsburg Passenger Railway, has applied to the council for permission to change the motive power of his road to electricity.

St. Louis.—The People's Railroad (cable) is to be sold under foreclosure proceedings to satisfy the claims of the third mortgage bondholders. The date of sale has not been fixed but it will probably be not later than the 1st of January. There is $800,000 in third mortgage bonds outstanding and the holders of these securities allege that the property has depreciated in value until it no longer is able to earn operating expenses, the value of the bonds being correspondingly depreciated.

Washington, D. C.—Charles J. Bell, appointed by the court trustee of the Belt Line Railway, has advertised the sale of the road to take place on November 15 next, at 2 o'clock. The sale will include all the rights and franchises of the company, together with its trackage, real estate, buildings and equipments. The terms of the sale provide that no one shall be allowed to become a bidder without having first made a deposit of $5,000. Within five days the successful bidder will be required to make a cash payment of not less than $62,000 or more than $75,000, which amount, it is estimated, will be necessary to meet the floating indebtedness, including the claims of the employes for wages and other bills recently decreed to be paid by order of the court. The company has 15 miles of single and 7½ miles of double track. The act of Congress passed at the last session requires that the purchaser shall equip the line with an underground electric system.

Westville, N. J.—The National Park Camp Meeting Association has decided to build a trolley line to Westville and Woodbury from the camp-meeting grounds.

Wilmington, Del.—Work is being pushed on the Wilmington & Brandywine Springs Electric Railway and it is intended to have its formal opening on November 1. Extensive improvements are under way at the Brandywine Springs Park.

Worcester, Mass.—The charter issued to the Worcester & Webster Street Railway Company authorizes the line to start near the city hall in Worcester, running through Auburn, Oxford and Webster to the postoffice in the latter town, about 15 miles. The capital is $150,000. The directors are Julius Garst, George A. Bigelow, E. L. Parker and F. P. Knowles of Worcester, E. S. Hill and H. S. Shaw of Webster, and L. E. Thayer of Oxford.

MANUFACTURING, ETC.

Chicago.—A. L. Kuehmsted, treasurer and general manager for the Charles E. Gregory Company in this city, is said to have just received an order for an electric light plant for North China. This plant, it is said, will be the first of the kind to be installed in that part of China. It consists of a 1,000-light dynamo, together with a complete equipment. It is considered by parties in the trade that this will be the beginning for quite a business in medium-sized plants from that part of the world.

Fort Wayne, Ind.—The Fort Wayne Electric Corporation is preparing to ship nine motors to London, Eng., in a few days. This is only one of the many foreign shipments the company has made this fall. It is stated that its dynamos, motors, meters and other apparatus are becoming quite popular abroad, and particularly with the English and Germans.

New York.—The "Journal of Commerce" in its export notes says: "Inquiries sent from Paris to electrical machinery manufacturers here strengthen the opinion that orders of some consideration are to arrive from that market early this winter. Two local manufacturing concerns are said to be figuring upon upwards of $200,000 worth of material required in various electrical undertakings in France. The orders that are at present arriving from France for this class of material are considered as being the best from any foreign market, not only for home consumption but for various foreign interests in which French capital is represented. Well posted parties say that for a period of more than six weeks the average weekly shipments of electrical material to Havre for distribution from there have amounted to nearly $10,000."

Oakland, Cal.—Superintendent Bishop of the Oakland Transit Company is quoted as saying that one of the great improvements contemplated by the company is the erection of an immense power house for the vast system of street railways now under its control, to be located on the water front. He says that it will be built on a scale never before attempted by any of the individual local companies. It will, moreover, be so designed as to admit of subsequent enlargements.

Pittsfield, Mass.—The "Journal" states that the Stanley Electric Company has secured through its San Francisco agency a contract for five transformers which are to be of an entirely new design and of the highest voltage of any machines of this kind that have ever been built. They are to be of 500 kilowatts or 675 horse power each, and are to be used on a transmission line extending from a distant point in the mountains to

San Francisco and other coast cities. The "Journal" says it is most probable that this order, which involves about $25,000, will be followed by others of a similar nature.

Washington, D. C.—United States Consul Prickitt writes to the State Department that the street railways at Rheims, France, which are now operated by horse power, are about to be changed to the electric trolley system, and suggests that contractors and furnishers of material for electric roads in the United States should compete for the contract. The railroads are operated by the Compagnie de Tramways de Reims, a Belgian company.

TRANSMISSION PLANTS.

Lowville, N. Y.—The Wetmore Electric Company expect to have their plant ready to supply electricity at the commencement of the new year. Work has been commenced on the transfer station on the Babcock farm east of this village. The stone building for the dynamo, water wheels and other machinery is already being constructed and poles are being strung from Belfort to Lowville.

Trenton, N. J.—The report is current that a company will soon be incorporated here to supply electric light, heat and power from a generating plant to be established at Morrisville. The rights of the Delaware River Improvement Company at that point are to be purchased and the water power improved so that at least 2,500 horse power will be available. Among the men reported to be taking part in the enterprise are John F. Dryden, president of the Prudential Insurance Company of Newark, N. J., Col. A. R. Kuser and Judge B. S. Woodruff of Trenton. It is said that besides putting up an extensive electric light and power works, the company proposes to purchase the rights of the Trenton Water Power Company, and negotiations to that effect have been begun with ex-Mayor Abram S. Hewitt of New York, the principal owner of the water power company.

COMPANY MATTERS.

Carthage, Mo.—The controlling interest held by Carthage people in the Southwest Missouri Electric Railway has been purchased by the Eastern owners for $336,200. The directory now includes four new Eastern men in place of the Carthage directors who retire. At the meeting of stockholders held on the 12th inst. at Carterville to confirm the sale the following directors were chosen: A. H. Rogers, president, Joplin; E. Z. Wallower, K. G. Neisley, H. L. Hershey, E. S. Herman, E. C. Felton, John E. Fox, W. J. Calder, Harrisburg, Pa.; Felton Bent, Philadelphia; J. F. Harrison, W. W. Calhoun, Carthage.

Johnstown, Pa.—A charter has been granted to the Johnstown & Somerset Traction Company, a corporation organized to build and operate a trolley line from this city to Windber, the new coal town of the Berwind-White Company in Somerset county. The board of directors is composed of Charles S. Price, Morris L. Woolf, David Barry, Herbert H. Weaver and Fred Krebs, all of Johnstown.

Toledo, O.—A deed has been filed in the recorder's office wherein the Toledo Electric Company transfers to the Toledo Traction Company all its franchise rights, privileges and property for a consideration of $375,000. The deed shows that the sale was consummated on October 11, but the transfer was really made about a year ago.

Troy, N. Y.—The "Record" states that "there has been a decided reconstruction of the Beacon Electric Company of Lansingburg and the company is now controlled by local stockholders. Samuel Bolton, Jr., has succeeded J. George Koebler as president, and Thomas Breslin of Waterford takes the place of vice-president left vacant by Mr. Bolton. Frank B. Twining has been elected a director in place of Albert Will of Rochester. The transfer of the majority of the stock to local holders had been for some time contemplated."

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—At a meeting of the Albany Institute Dr. William Hailes will read a paper on "Electrical Microscopic Projection."—Ever since the General Electric Company obtained possession of the Schenectady street railway it has been rumored that this company will extend its system from Schenectady to cities and towns in the Mohawk Valley and to Albany. Should this prove true, as many hope and believe, it is thought that most of the roads in Albany county would be operated by power obtained from the Mechanicville dam on the Hudson.

Cohoes, N. Y.—The conductor and engineer of the Delaware & Hudson train which struck the car of the Troy City Railway on Labor Day were arraigned for violating the city law in running at greater speed than eight miles an hour through the city. The defendants have entered a demurrer stating that the ordinance is invalid and void for several reasons which they state.

Schenectady, N. Y.—Lieutenant S. Dana Greene, former executive officer on the cruiser Yankee, gave an interesting address at the First Presbyterian Church October 20. The lecture attracted a large attendance. The subject of the lecture was the Navy and the experiences of the speaker as executive officer during the late war. His descriptions of the conditions in Cuban waters during the blockade were intensely interesting, especially in regard to the magnificent courage of the men who were detailed to cut the submarine cables. The speaker thought the behavior of these men had been too much slighted by the newspapers.

Hoosick Falls.—The electric railway from Hoosick Falls to Bennington is now running without the necessity of any transfers. The company's large iron bridge, which was displaced by the recent cloud-burst, is replaced by a trestle 150 feet long, over which the cars run. The electric company has given permission to the town officials to plank their iron bridge at North Hoosick, thus affording the public means to reach the village from the north with teams.

PERSONAL AND MISCELLANEA.

A baker at West Belleville, Ill., has put in electrical machinery to operate his bakery at an expense of $2,000. The plan has proved a success. The entire plant can be operated by one man and a boy and will turn out 9,000 loaves of bread in 24 hours without any danger of burning or suspicion of uncleanliness.

The Columbus, O., "Dispatch" states that Railroad Commissioner Kayler is calling the attention of municipalities to the practice of placing electric lights directly over the railroad tracks at street crossings. The presence of such a strong light is blinding to the engineer and defeats its purpose, often preventing the engineer from seeing persons on the tracks. The commissioner has been corresponding with mayors of cities in which such lights are located and has been meeting with satisfactory compliance.

A miniature electric searchlight for the use of policemen, watchmen, miners, engineers, etc., is on the market. It is a great improvement on the old oil-burning lamp. The new light is club shaped, made of leather with nickel trimmings, with a lens in one end that throws a brilliant light of considerable dimensions. Flashed in dark corners, in the rear of stores, in dark streets, it quickly reveals any person or thing. The light is of three and a half volts and the lamp in length is 8 or 9 inches and weighs about a pound. It is said to be good for several thousand flashes by simply pressing the thumb on a clasp. The illumination is furnished by a dry battery which may be replenished at a cost of 30 cents. The light complete costs $4.

William Henry Walsh of Albany, N. Y., has invented an ingenious system of automatic electric signals for railways which it is claimed will render impossible railway collisions and accidents from breaks or wrecks on the road. A representative of the "Weekly Press" of Albany, who witnessed the working of the system as shown by means of a miniature model, gives this description of it: "On a board, something over a yard square, was a system of brass rails, illustrating intersecting railways, or a crossing, over which the inventor runs a number of little engines equipped with his principle. In plain words the system may be thus explained: It is on the block, but not on the tower plan. Electricity is the agent and the signal box is in the cab of the engineer. Midway between the rails is another rail, a continuous and closely jointed metal rod. Connection is made with the engine or train by metallic brushes, or brooms, which sweep the rod. These brushes are connected with the battery in the engineer's cab. Each alternate block of the road is unwired. The instant the engine reaches a block, should there be ahead any breakage of rails, misplaced switch, part of a parted train, sinking of road bed, landslide, or anything else to cause a separation of rails, the bell rings in the engineer's cab and warning is given. Neither can a train enter a block while another is on the same block without the ringing of the alarm bell. The device is also designed to render impossible any accident by collision on crossings or intersecting roads. The reporter desired to ask questions and be allowed to cause an accident, both of which privileges were accorded him. Then he became a train wrecker for the nonce. He put obstacles on the tracks, misplaced switches, broke trains in twain and with devilish malice intent attempted to bring about head-on and tail-end collisions. He broke embankments, put rocks on the rails, spread them, undermined the road-bed; in short did everything fiendish in the way of causing a disaster, and each and every one of his felonious plans were prevented and frustrated by Mr. Walsh's wonderful invention."

RECENT COMPANY ELECTIONS.

Fairmount Park Transportation Company, Philadelphia, Pa.—President, Charles A. Porter; vice-president, Robert H. Foerderer, to fill the respective vacancies caused by the resignations of James Rawle and John W. Henderson. The directors of the company, additional to the elected officers, are: J. H. W. Chestnut, Frederick S. Dickson, Dr. L. F. Flibert and John B. Peddle, of New Jersey.

Electric Clock Company, Bangor, Me.—President and general manager, Joseph S. Smith; vice-president, Samuel R. Prentiss; superintendent, Walter J. Dudley; directors: Joseph S. Smith, John B. Foster, Charles V. Lord, Samuel R. Prentiss, Bangor; Arnold A. Rand, Philip A. Jenkins, Boston.

Meriden Electric Railroad Company, Meriden, Conn.—President, N. H. Heft; secretary and treasurer, W. L. Squire; directors: John L. Billard, John O. Byxbee, E. J. Doolittle, John M. Hall, N. H. Heft, John W. Mix and Charles L. Rockwell.

Nashua Street Railroad Company, Nashua, N. H.—Directors: John A. Fisher (president), August Fels, Percy Parker (treasurer), E. M. Tucke, F. C. Anderson, E. A. Smith and Miles F. Brennan. John P. Goggin was re-elected clerk.

Southbridge & Sturbridge Street Railway Company, Southbridge, Mass.—President, Calvin D. Paige; treasurer, F. L. Chapin; superintendent, Herbert H. Morse; directors: Calvin D. Paige, Francis L. Chapin, George W. Wells, Jacob Booth, Henry C. Cady, Albert H. Wheeler, Thomas S. Robinson, and Charles W. Hill and Chauncey M. Wells, auditors.

Toledo Traction Company, Toledo, O.—President, Albion E. Lang; vice-president and general manager, T. H. McLean; treasurer, W. E. Hale; secretary, Barton Smith; directors: the officers and N. B. Ream, J. E. Blair, John B. Dennis, Rufus H. Baker and W. H. McLellan.

Trenton Light & Power Company, Trenton, N. J.—Directors: James Moses, Richard A. Donnelly John Moses, G. D. W. Vroom, Alex. O. Yard, J. Ridgeway Fell, Charles T. Hughes and William B. Allen.

Worcester & Clinton Street Railway Company, Clinton, Mass.—President, A. S. Paton; vice-president, W. S Reed; clerk and treasurer, Walter R. Dame; directors: A. S. Paton, George R. Damon, W. S. Reed, George P. Damon, all of Leominster; James Marble and Col. T. S. Johnson, of Worcester; George A. Flagg, of Boylston, and Walter R. Dame, of Clinton.

Worcester & Webster Electric Railway Company, Worcester, Mass.—President, Julius Garst; vice-president, Fred Thayer; auditor, E. L. Parker; clerk, E. S. Hill; these officers and E. E. Carpenter, W. A. Bailey and H. F. Leland constitute the board of directors.

Yonkers Electric Railroad Company, Yonkers, N. Y.—Owing to the consolidation of the Yonkers Electric Railroad with the Union Railway Company, the officers of the Union road have been elected by the directors as officers of the Yonkers road. They are: Edward A. Maher, president; Albert J. Elias, vice-president; Thomas W. Olcott, secretary and treasurer. The change has brought about the retirement of M. F. H. Gouverneur from the position of general manager of the Yonkers road, that office having been abolished. Allan F. Edwards retains his position as superintendent of the Yonkers Division.

COMMERCIAL PARAGRAPHS.

The Montauk Multiphase Cable Co., 100 Broadway, New York, received the following note recently from the Milwaukee Auxiliary Fire Alarm Company:

Milwaukee, Wis., Oct. 1, 1898.

Montauk Multiphase Cable Co., New York.

GENTLEMEN: I am pleased to say that the Fire Department endorses and authorizes your cable for use in connection with our Auxiliary system here, Chief Foley telling me recently to "go ahead" with it. Superintendent Glassner of the Fire Alarm Telegraph has expressed himself as satisfied. Yours truly,

THOMAS R. MERCEIN,
Secretary and General Manager.

The name Packard is a synonym for everything that is progressive in the electrical line. It has always been the policy of the Packard Company to improve their material whenever opportunity offered. Their model '98 Packard Transformer represents their latest improvement in the transformer line. They claim to have a transformer which is at the very top notch of transformer construction. They have a novel plan of guaranteeing just exactly what each transformer will do. All of their claims, guarantees, etc., are fully set forth in a special circular, which can be had from the Electric Appliance Company, Chicago, Western agents for the Packard goods.

INCORPORATIONS.

The Electric Current Company, New York—to furnish electricity. Capital stock, $3,000.

The Northwestern Electric Heat & Power Company, Macon, Mo. Capital stock, $30,000. Incorporators: F. W. Blees, John F. Schafer and Charles E. Roehl.

The Illinois Traction Company, Chicago. Capital stock, $10,000. Incorporators: Augustus Kelly, Thomas S. Jackson and Clara L. Clayton.

The Hinsdale Light & Power Company, Lake City, Col.—to supply electric light and power to the mines. Capital stock, $100,000. Incorporators: R. E. Teniston, D. K. Anders and T. F. Ashworth.

The Standard Electric Construction Company, Rochester, N. Y.—to manufacture and deal in electrical apparatus. Capital stock, $5,000. Directors: Edgar H. Freeman, Walter H. Tobey, Burton A. Vandy, all of Rochester.

The Joplin Illuminating Company, Joplin, Mo. Capital stock, $80,000. Stockholders: John C. Porter, Harrison I. Drummond, Charles Nelson, John S. Dunham and Francis Kuhn.

The Milford & Goshen Street Railway Company, Cincinnati, O.—to build and operate an electric railway in Hamilton and Clermont counties, Ohio. Capital stock, $10,000. Incorporators: William A. Goodwin, M. C. Campton and others.

The Bay Ridge Electric Park & Steamboat Company, Baltimore, Md.—to conduct a pleasure resort and run a steamboat line. Capital stock, $50,000. Incorporators: Julius M. Jackson, Edward D. Crook, John R. K. Collins and Louis K. Meyer.

The Lake City Power Company, Denver, Col.—to furnish electric light and power in and around Lake City from a plant to be established at an available point on the Gunnison river. Capital stock, $50,000. Incorporators: David K. Lee, B. Gibson and Frank C. Gaudy.

The Insulated Wire Company, Jersey City, N. J.—to deal in insulated wire and other goods. Capital stock author-

ized, $500,000. Incorporators: Samuel B. Lawrence and John B. Summerfield, New York, and Burnham C. Stickney, Elizabeth, N. J.

The Pike's Peak Power Company, Council Bluffs, Ia., and Colorado Springs, Col.—to acquire the rights and privileges granted to George W. Jackson by the city of Colorado Springs, conferring the right to lay underground conduits and wire cables and to erect poles and string wires to furnish electric power. Capital stock, $100,000. Directors: Thomas A. Whelan, F. A. Chapman, Henry M. Blackmer and Van Lear Black. Chancellor L. W. Ross will represent the company in Iowa.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCTOBER 18, 1898

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

12,410. Electric Trolley Device. Alfred J. Gairing, Johnstown, Pa., assignor to the Steel Motor Company, same place. Filed Aug. 3, 1898.

612,457. Electric Railway. Charles H. Myers, Buffalo, N. Y., assignor to himself and Percy Marvin, same place. Filed Aug. 18, 1897.

612,641. Depressible-Rail System for Electrical Railways. William Grunow, Jr., Bridgeport, Conn., assignor of one-half to Zalmon Goodsell, same place. Filed July 10, 1897.

612,696. Rail-Joint for Electric Railways. Max Barschall, Berlin, Germany. Filed March 14, 1898.

612,703. Automatic Electrically-Controlled Railway-Switch. Robert V. Cheatham, Louisville, Ky. Filed March 12, 1898.

612,785. Street-Car Fender. George A. Parmenter, Cambridge, Mass. Filed July 11, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

612,556. Electric-Arc Lamp. Charles A. Vigreux and Lucien V. Brillie, Levallois-Perret, France. Filed March 30, 1898.

612,560. Electric-Lamp Socket. John E. Origgal, Newark, N. J. Filed Nov. 4, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

612,629. Means for Controlling Operation of Electric Motors. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Brothers & Company, New York City. Filed Jan. 26, 1898.

TELEPHONE AND TELEGRAPH APPARATUS.

612,681. Telephone-Exchange Mechanism. Harlen P. Snow, Erie, Pa., assignor of one-half to Frederick C. Jarecki, same place. Filed Nov. 1, 1897.

612,782. Coin-Actuated Signal Apparatus. Heber R. Mason, Ludington, Mich., assignor to the Mason Telephone Pay Station Company, same place. Filed Dec. 31, 1897.

SIGNALS AND SIGNALING APPARATUS.

612,708. Electric Signaling Apparatus. William E. Decrow, Boston, Mass., assignor to the Gamewell Fire Alarm Telegraph Company, New York City. Filed Dec. 27, 1897.

612,709. Electric Signaling Apparatus. William E. Decrow, Boston, Mass., assignor to the Gamewell Fire Alarm Telegraph Company, New York City. Filed Jan. 4, 1898.

MISCELLANEOUS.

612,426. Electric Meter. William D. Marks and George R. Green, Philadelphia, Pa., assignors to the American Electric Meter Company, same place. Filed Jan. 10, 1898.

612,427. Electric-Meter Case. William D. Marks, Philadelphia, Pa., assignor to the American Electric Meter Company, same place. Filed Jan. 10, 1898.

612,441. Electric Time Alarm. Herbert D. Tenny, Milford, Mich. Filed Feb. 19, 1898.

612,535. System for Insulation of Electric-Conductor Wires. Jonathan H. Vail, Philadelphia, Pa. Filed Feb. 26, 1898.

612,649. Battery-Electrode. Herbert S. Lloyd, Philadelphia, Pa. Filed Sept. 20, 1897.

612,670. Electric-Cable Switch. Addison Norman, Toronto, Canada, assignor of one-fourth to William McCabe, same place. Filed April 19, 1897. Renewed June 29, 1898.

612,694. Process of Simultaneously Producing Carbids and Metals or Alloys. Heinrich Ascherman, Cassel, Germany. Filed March 30, 1898.

612,781. Electric Meter or Indicator. William D. Marks, Philadelphia, Pa., assignor to the American Electric Meter Company, same place. Filed Feb. 7, 1898.

612,789. Electric Self-Loading Street-Cleaning Car. Andrew J. Reynolds, Worcester, Mass. Filed Feb. 2, 1897.

TELEPHONE AND TELEGRAPH.

The Telephone Dispute in Washington.

Comptroller of the Treasury R. J. Tracewell has rendered a decision relative to the controversy between the United States Government and the Chesapeake & Potomac Telephone Company which will probably hasten the action of the Supreme Court of the United States as to the constitutionality of the Act of Congress, passed June 30, 1898, fixing the price for telephone service in the District of Columbia at $50 per annum for the use of a single telephone instrument on a single wire. The Washington *Times* explains the circumstances which led to the Comptroller's decision: "In August, 1897, the Government Printing Office entered into a contract with this company [the Chesapeake & Potomac] to be furnished telephone service at the company's price. June 20, 1898, Congress passed a law fixing the amount which may be paid for the use of telephones in the District of Columbia. The Public Printer claims that this act of Congress invalidates the contract entered into by the Government Printing Office and the Chesapeake & Potomac Telephone Company. The telephone company disputed the law in this case and the matter was left to the decision of the Comptroller of the Treasury. Mr. Tracewell's ruling is that the telephone company must furnish both individuals and the Government the benefits of its telephone system, and do this under the rule of charges fixed by law, or give way to others who will."

The Syracuse, N. Y., *Herald* states that Frank L. Woods, receiver of the New York State Telephone Company, is the plaintiff in actions at law just begun against the Auburn Telephone & Service Company and the Oneida Telephone Company, sued jointly, and George McClumpha. The first action is to set aside the alleged illegal transfer of stock and property which it is claimed were conveyed to the defendant companies when the plaintiff's company was about to become insolvent. Fifteen thousand dollars is the alleged value of the stock and property. The same questions are involved in the suit against McClumpha.

A new telephone company has been organized at Wilkes-Barre, Pa., to be known as the People's Telephone Company of Wilkes-Barre, and with Samuel E. Wayland as manager has perfected arrangements to begin work at once in getting its lines ready for operation. The company has a State charter and franchise and proposes giving service through long distance telephones. The stock of the company is held by local capitalists, among them John W. Hollenback, George A. Bedford, W. A. Lathrop, Abram Nesbitt, Irving A. Stearns, C. F. Stegmaier and A. Markle.

The Home Telephone Company of Cleveland has applied to the Board of Control for official sanction of a formal transfer of its property in Cleveland to the Cuyahoga Telegraph & Telephone Company, which corporation, if the petition is granted, will operate the Home Company's lines in Cleveland.—The Union Suburban Telephone & Telegraph Company of Cleveland has been officially authorized to change its name to The United States Telephone Company.

At a meeting of the board of directors of the Western Union Telegraph Company in New York on the 19th, the old officers were all re-elected, with the exception that Thomas F. Clark, acting vice-president, was elected vice-president and was also elected director in place of J. W. Clendenin, deceased, and that M. T. Wilbur, assistant treasurer, was elected treasurer in place of R. H. Rochester, deceased.

Cleveland, O., is being extensively conduited at the present time. Four different companies are laying conduits for electric wires in various parts of the city. The companies are the Cleveland Telephone Company, the Home Telephone Company, the Postal Telegraph Company and the Cleveland Electric Illuminating Company.

The Union Extension Telephone Company has been organized at Union, S. C., with M. W. Bobo of Sedalia as president and general manager and Allan Nicholson of Union treasurer and manager of the Union end of the line. The company gives connection with Sedalia, Cross Keys, Enoree, Laurens, Abbeville, Anderson, Belton, all in South Carolina, and expects to soon connect with Spartanburg.

Colorado Springs capital has become interested in a new telephone line to be erected in Oklahoma, $20,000 having been subscribed for the construction. The new company will be known as the South McAllester Telephone Company.

A press dispatch from Reading, Pa., states that the city councils have struck from the calendar the ordinance giving the Pennsylvania Independent Telephone Company the privilege of the streets to start a telephone service for which it had secured over 300 subscribers.

The Drawbaugh Telephone Company.

The Drawbaugh Telephone Company of Philadelphia, which filed plans of its proposed system in that city with the Board of Highway Supervisors recently, has a capital stock of $2,000,000 and its purpose is to furnish a complete telephone service at the uniform annual rate of $75 for business places and $50 for residences. The plans filed show that the company intends to cover every part of the city of Philadelphia with its system, and one novelty, compared with the system made familiar to telephone users, will be that there will be no central station in the sense that one is now necessary. Each branch station will practically be a "central" for the subscribers in the district in which it is located. The officers and directors of the company are: President, Col. J. F. Stokes; secretary, Charles A. Gladding; treasurer, John D. Ford; directors: Albert Baltz, Henry Levis, Henry H. Hallowell, Edwin S. Cramp, Charles E. Hodges, J. F. Stokes, John D. Ford, Charles A. Gladding, William O. Hampstead, Herman A. Lang and Samuel F. Kent.

A press dispatch from Richmond, Ky., states that local capitalists are trying to buy up and consolidate the various telephone lines in Central and Eastern Kentucky. There are 25 lines, reaching nearly every county seat from Somerset on the south to Maysville on the north. It is estimated that it will take $100,000 to buy the various lines.

The People's Telephone Company at New Orleans has begun the construction of its conduits. William P. Curtis, the general manager of the new company, in speaking of the present and future plans of the enterprise, is very hopeful of its success, and predicts a new spirit of progressiveness as a result of the competition afforded.

The United States Supreme Court has declined to advance the case of the city of Richmond against the Southern Bell Telephone and Telegraph Company. It will not, therefore, be reached before March or April of next year.

A telephone line between Tacoma, Wash., and San Francisco, with branch lines to British Columbia and Mexico, has just been completed, making the longest telephone line in the United States.

A dispatch to the New York *Commercial* from Kansas City, Mo., states that the Standard Telephone Company has bought all the lines and equipment of the Central Missouri Telephone Company.

The Erie Telegraph & Telephone Company reports that it added 1,094 subscribers to its system during the month of September last. The total number connected October 1 was 28,771.

The long distance telephone line connecting Birmingham, Ala., with Nashville, Chattanooga, New York and other cities has been completed.

The telephone system at Sioux Rapids, Iowa, connecting that city with several surrounding towns, has been thrown open to the public.

New Companies Incorporated.

The Amherst Telephone Company, Amherst, Mass. Capital stock, $4,000.

The Citizens' Telephone Exchange, Peoria, Ill. Capital stock, $200,000. Incorporators: Deloss S. Brown, Hart F Farwell and John Skinner.

The People's Telephone & Telegraph Company, Worcester, Mass. Capital stock, $150,000. President, Israel L. Currier; treasurer, Fred W. White.

The People's Telephone Company, Lockport, Ill. Capital stock, $12,000. Incorporators: Allen G. Hawley, Charles B. Cheadle and Thomas Cheadle.

The Rivershore Telephone Company, Burlington, N. J.—to do a telephone and telegraph business. Capital stock, $15,000. Incorporators: Nathan Haines, J. Howard Pugh and George C. Gunn of Burlington; Mitchell B. Perkins, Beverly, N. J.; Henry V. Massey, Philadelphia.

The National Automatic Telephone Company, with principal office in Chicago, Ill., has been incorporated at Charleston, W. Va., by John Anderson, E. W. Ober, W. W. Watson, C. A. Watson, L. A. Will, F. A. Lundquist and J. D. Milliken. Authorized capital stock, $1,000,000.

The Oakland Messenger, Burglar & Fire Alarm Company, Oakland, Cal.—to erect, maintain and operate telegraph lines in Oakland for the purpose of transmitting burglar, fire, police, messenger and other signals and send and receive telegraph messages in the city. Capital stock, $20,000, of which $6,050 has been subscribed. Incorporators: Albert Anker of Tehachapi, Henry N. Beck and Frederick Kahn of Oakland, Philip Marx of Los Angeles and Edward I. Wolfe.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Oct 24:						
Albany Ry. Co	100	2,000,000	†1,750,000	1½ % Q., Aug. '98.	151	158
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug., 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Oct 24:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Oct 24:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Oct 24:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98.	70	70½
*a*Baltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	21⅞	25
Central Ry. Co. of Baltimore City	50	300,000	800,000	3 % A. Dec., 1897.	...	..
Boston, Mass.—Oct 24:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97	13¼	13¾
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	10½	12
North Shore Traction Co.......pfd.	100	2,000,000	2,000,000	3 % S., A. & O.	78½	80
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	85¼	85¼
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	105	106
Boston Elevated R. R	100	10,000,000		2¼ % Aug. 98,	69¾	70
Brooklyn N. Y.—Oct 24:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	64½	64¾
*c*Brooklyn Heights Railroad	....	200,000	200,000	....	..	..
**d*Brooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	220	..
*e*Brooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	230	..
Kings County Elevated	....	4,750,000	4,750,000	....	5	5¾
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	70	..
*f*Atlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
*g*Brooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Oct 24:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	65	66
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	79½	80¼
Columbus O.—Oct 24						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Aug., '98.	5½	51
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Oct 24:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '98	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Oct 24:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q.	290	292½
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12	13
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Oct. 98.	215	216½
*h*North Chicago City RR	100	500,000	249,900	.....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	......	..	..
*i*West Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Oct 98	93	93½
*j*Chicago West Div. Ry.......guar.	....	1,250,000	624,900	35 %	..	..
*k*Chicago Passenger Ry........guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Oct 24:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	23	25
*l*Cincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	117	117¼
Mt. Adams & Eden Park Inc. Ry	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Oct 24:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¼ % Jan., '98	39	41
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	70	74
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98	79¾	81
Detroit, Mich.—Oct 24:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Oct 24:						
City Railway Co............com.	100	1,500,000	1,470,600	1¼ % Q., Jan 1, '98.	103	..
City Railway Co...............pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	103

*Unlisted. †Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Oct 24.						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	–
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	–
Holyoke Mass.—Oct 24						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	180	200
Hoboken, N. J.—Oct 24:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	–
Indianapolis, Ind—Oct 24:						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	24	25½
Lancaster, Pa.—Oct 24:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	–
Lancaster & Col. Electric Ry	....	... ...	87,500	....	..	–
West End Street Railway	...	....	....	....	..	–
Louisville, Ky.—Oct 24:						
Louisville Ry..............com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	84	89
Louisville Ry..............pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	96	100
Minneapolis, Minn.—Oct 24:						
Twin City Rapid Transit.......com.	100	17,000,000	15,010,000	....	27	30
Twin City Rapid Transit....7 % pfd.	..	8,000,000	1,714,200	1¾ %. Jan., '98.	99	101½
Montreal, Canada.—Oct 24:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	275¼	276
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¼ % S., J. & J.	103¼	103½
Memphis, Tenn.—Oct 24:						
Memphis Street Railway Co	100	500,000	500,000	....	15	–
New Haven, Conn.—Oct 24:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—Oct 24:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	150	..
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	121½	125
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	1½	8½
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	8	11
*a*Crescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	14½	32
*b*New Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	83	85
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23	25½
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	52½	55
New York—Oct 24.						
Central Crosstown RR	100	600,000	600,000	2½ % Q	250	..
*c*Christopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98	170	185
*d*Metropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98	158½	158¼
*e*Bleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	34½	87
*f*Broadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	218	220
*g*Cen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	180	185
*h*Eighth Avenue RR	100	1,000,000	1,000,000	....	350	370
*i*42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	365
*j*Ninth Avenue RR.........guar.	100	800,000	800,000	....	183	190
*k*Sixth Avenue RR...........guar	100	2,000,000	2,000,000	....	200	210
*l*Twenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	340	375
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	178	180
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. 18.	150	55
*m*42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	70	72
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	190
Newark N. J.—Oct 24						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	50	50½
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	
*n*Rapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Oct 24:						
Allegheny Traction Co	50	500,000	500,000	....	...	..
*o*Consolidated Traction Co....com	50	15,000,000	15,000,000	2 %, Jan., '95.	2[illegible]	20½
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	56¼	..
*p*Central Traction Co	50	1,500,000	‖900,000	....	.	
*q*Citizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	64½	65
*r*Duquesne Traction Co	50	3,000,000	‡3,000,000	6 % A.	..	...
*s*Pittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	..	.
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	24½	25
Pgh., Allegheny & Man. Trac. Co	50	3,000,000	‖2,994,839	2 %, Aug., '95.	..	.
Pittsburg & Birmingham Trac. Ry	25	3,000,000	3,000,000	½ %, Jan., '96.	23⅞	2[illegible]
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	300,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds..

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $8,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October,

s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Oct. 24;						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass—Oct 24:						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Oct 24:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	80
Paterson. N. J.—Oct. 24:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Oct 24						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	70	72
Philadelphia.—Oct 24:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98	67	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	300,000	3 % Feb. 1, '98.	65½	66
Union Traction Co.......... $12½ pd	50	30,000,000	29,930,450	....	19¼	19⅜
cElectric Traction Co	50	....	8,297,920	....	71⅜	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	3 7	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	394	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	47	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	265	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135	136
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh., Oct. 98.	91	91¼
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	170	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	285	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	275	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.—Oct 24:						
Rochester Railway Co	100	5,000,000	5,000,000	....	12	20
Reading, Pa.—Oct 24:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	...
St. Louis Mo.—Oct 24:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct '98.	131	133
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR.	100	2,000,000	1,500,000	1 %, Oct., '98.	90	110
St. Louis RR.	100	2,000,000	2,000,000	2¼ %, July, '98.	95	105
Missouri RR.	50	2,400,000	2,300,000	1½ % Oct., '98.	170	175
People's RR. Co	50	1,000,000	800,000	50c., Dec., '89.	..	..
Southern Electric Ry.........com.	100	500,000	500,000	....	57½	59½
Southern Electric Ry.....6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	114	116
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	52	53
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Oct.						
California St. Cable RR.	100	1,000,000	600,000	50c. monthly.	108	109
Geary Street Park & Ocean RR.	100	1,000,000	875,000	$2.50 share, '96.	46	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	54¾	55
Presidio & Ferries RR.	100	1,000,000	550,000	....	9	..
Scranton, Pa—Oct 24:						
Scranton Railway Co	50	6,000,000	2,500,000	....	11	15
m Scranton & Carbondale Trac. Co.	100	500,000	500,000	....	15	18
m Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Oct 24:						
Springfield Consolidated Ry	100	750,000	750,000	....	—	11
Springfield O.—Oct 24:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—Oct 24:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	195	205
Toronto Canada.—Oct 24:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	103	103½
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.	275¾	276
Washington, D. C.—Oct 24:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	78½	78¾
Columbia Ry. Co	50	400,000	400,000	6 % A.	70	75
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	..	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	..	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	123	126
Worcester, Mass.—Oct 24:						
*Worcester Traction Co........com.	100	8,000,000	8,000,000	....	12½	12¾
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	96	98
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Oct 24:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Oct 24						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., Oct., '98.	..	275
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '98.	74¼	75
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	136	..
New York.—Oct 24:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	97	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	109	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	179	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	45
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	74	75
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	..
*International Ocean Tel Co.guar 6%	100	8,000,000	......	1½ % Q.	110	112
Mexican Telephone Co	100	2,000,000	......		..	.65
*New York & New Jersey Tel. Co.	100	5,000,000	8,723,000	1½ % Q., July, '98.	151	154
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	78	78
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union Telegraph Co	25	500,000	500,000	8 % S., July, '98.	110	118
Western Union Telegraph Co	..	......	97,870,000	1¼ %, Oct., '98.	91	91⅛
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Oct 24:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	171	178
Chesapeake & Potomac Telep. Co.	100	......	......	....	88	...
Chicago Telephone Co	100	......	......	......	242	..
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	182	184½
Empire & Bay States Telegraph Co.	...	......	......	....	74	76
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	75	76
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	110	118
Providence (R. I.) Teleph. Co	50	....	......	....	87	90
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Oct 24:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec Series A.	25	......	......	....	...	..
†General Electric Co. [old] ... com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new] ...... "	100	18,276,000	18,276,000	......	80½	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	33½	34
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., Oct., '98.	57	58
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Oct 24:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,938,000	....	127	130
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1¼ % Oct., '98.	..	..
Edison Ore Milling Co	100	......	......		11	14
Edison Electric Storage Co	..	......	......		28	30
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug, 1898.	..	..
General Electric Co. [new]	100	18,276,000	18,276,000	......	80½	81½
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	......	41	..
Pittsburg, Pa.—Oct 24:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	130	140
East End Electric Light Co	50	300,000	300,000	Q	..	10
Philadelphia, Pa.—Oct 24:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	88	88½
*Electric Storage Battery Co....pfd.	100	5,000,000	......	......	45½	45¾
*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	..
*Penna. Ht., Lt. & Pow. Co......pfd.	50	5,000,000	......	6 %, Oct., '97.	..	.
Northern Elec. Light & Power Co.	10	6,500,000	550,000	$82500 dis. Jan.11'97	13¾	14
Southern Elec. Light & Power Co.	10	187,500	187,500	......	16	..
Miscellaneous.—Oct 24:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	32	35
Missouri-Edison (St. Louis)....com.	..	......	......	......	12	14
Eddy Electric Mfg. Co	25	......	......	......	—	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	......	122	127
Hartford (Conn.) Lt. & Power Co	25	175,000	......	......	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	......	170	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	84	87
Rhode Island Elec. Protec. Co	100	......	......	......	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	......	2% Q	154	156
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	‡135	137
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	......	95	100

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Oct 24:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	85	87
New York.—Oct 24:						
Consolidated Electric Storage Co	...	......	....	....	18	20
Edison European	..	......	....	....	1	3
Safety Car Heating & Lighting Co	100	......	....	....	100	105
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	34	40
Worthington Pump Co........pfd	100	2,000,000	2,000,000	7 %	96	99
Philadelphia, Pa.—Oct 24:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co......com.	100	3,500,000	......	....	15	17
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	60	65
Welsbach Light Co	5	525,100	......	....	43½	44
Welsbach Light Co., Canada	5	500,000	......	....	..	2¼
Pittsburg, Pa.—Oct 24						
Carborundum Mfg. Co	100	200,000	200,000			
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	117	119
Miscellaneous.—Oct 24:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	...	15
*Barney & Smith Car Co.......pfd.	100	......	2,500,000	2 %	..	55
Billings & Spencer Co	25	......	......	....	30	35
Consol. Car Heating Co	100	1,250,000	1,250,000	1¼ % Feb. '98.	32	35½
Johns-Pratt Co	100	......	......	....	90	100
*Pratt & Whitney Co..........com.	100	......	......	....	4	8
*Pratt & Whitney Co..........pfd	100	......	......	....	45	50
Stillwell-Bierce Co..........com.	..	......	......	....	70	80
Stillwell-Bierce Co..........pfd.	..	......	......	....	96	98
Shultz Belting Co	100	500,000	......	2 % Sept. 1, '97.	80	..
St. Charles Car Co	—	......	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Oct 24, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112½	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR.1st mtg. 6s	850,000	850,000	1919	M. & N.	*119½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co...................1st 5s	....	....	......	......	*106½	......

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Oct 24, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	118½	117
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115½	116
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	102¾	103¼
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115½	116
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	102½	104
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co...........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	..
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	118	120
City & Suburban Ry......1st mtg. g 5s	3,000,000	3,000,000	1922	J. & D.	115	115¾
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113½
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	120

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	104¾
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105½
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	...
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry...........1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102⅛	102½
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T..............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	105¼	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	59	60
North Chicago St. RR........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¼	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	107	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	101½
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	95	......
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Oct 24, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	105	105½
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	......	119½
‖So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	....	135

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	105	105½
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	103	104½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	.....	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	...
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	98½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1913	M. & S.	106	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 5	100,000	94,000	1909	M. & S.	102	......

New Orleans La.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR............1st mtg. 6s.	......	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83	83½
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	.....
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	104	104½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	......	....
‡St. Charles St. RR. Co......1st. mtg. 6s	300,000	75,000	1906	J. & D.	105	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	109½	1 0½
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	121½	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	106	110
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	106	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	......	......
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	88
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109½	110
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	103¾	103½
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	104	....
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	103	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111	113
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115¾	116½
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101½	102
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	...
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	114½	116
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	96	98
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	121½	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1 ,500,000	1997	F. & A.	114	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600 000	1909	M. & N.	114½	115
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	109	......
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124½	......
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	118	115
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	110	112½

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Oct 24. 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Oct 24, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry......................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry...................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry...................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	105	......
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co.................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	.....
West End Passenger Ry.........1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Oct 24 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	94½	......
Central Traction Co...............1st mtg. 5s.	375,000	375,000	1930	J. & J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	110½	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	106½	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	......	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co......................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation - Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	.....
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	108	109

St. Louis.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1913	J. & J.	111½	112½

*With interest. *Unlisted.

*With interest.

PASSENGER RAILWAY.

St. Louis.

Date of Quotation—Oct 21, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co........................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co..........................	1,000,000	700 000	1916	M. & S.	107	108
‡Mound City RR. Co..............1st mtg. 6s.	400,000	300 000	1910	A. & O.	101	108
People's RR. Co.......................1st mtg. 6s.	125,000	125 000	1902	J. & D.	98	101
‖People's RR. Co.....................2d mtg. 7s.	75,000	75 000	1902	M. & N.	97½	100
People's RR. Co................Cons. mtg. 6s.	1,000,000	800 000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75 000	1905	J. & J.	100	101
St. Louis RR. Co......................1st mtg. 5s.	2,000,000	2,000 000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400 000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry................Income 5s.	800,000	800 000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500 000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500 000	1913	J. & J.	112	113
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,737,000	1918	J. & J.	114½	115½

†Controlled by St. Louis RR. Co.
‡Controlled by Union Depot RR. Co.
¶Controlled by Lindell RR. Co.
‖$200,000 in escrow to retire 1st & 2d mtg.
§$600,000 in escrow.
††$200,000 in escrow to retire 1st mtg. bds.

San Francisco Cal.

Date of Quotation—Oct, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	116½	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	116½
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	94	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	127½	129
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	...	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	128⅝	130
†Park & Cliff House RR........1st mtg. 6s.	350,000	350,000	1912	J. & J.	106	....
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	112	......
†Powell St. Ry.........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	120
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......

†Controlled by Market St. Ry. Co.

Washington D. C.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Belt Ry. Co. ....Cons mtg 5s.	500,000	450,000	1920	J. & J.	......	
Columbia Ry............................ mtg. 6s.	500,000	500,000	1914	A. & O.	122	126
Eckington & Soldiers' Home mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	125	......

†$50,000 in escrow to retire 1st mtg. bds.

Miscellaneous.

Date of Quotation—Oct 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	113½	114
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	1,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	110¼	11 ¾
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	98	101
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	107½	107¾
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	100	102
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	115	115½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	98	102
††No. Hudson Co. Ry. (N. J.). Cons. mtg. 5s	3,000,000	2,378,000	1928	J. & J.	103	104
No. Hudson Co. Ry. (N. J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	100	101
St. Paul City Ry.....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½

†$1,000,000 in escrow to retire 1st and 2d mtg. bds.
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.
‖$87,000 in treasury.
§$960,000 res'ved to redeem prior liens.
††$620,000 in escrow.

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.

Date of Quotation—Oct 24, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	109	....

Pittsburg, Pa.

Date of Quotation—Oct 21, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1913	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......

Miscellaneous.—(Oct 24, 1898.)

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	110	115
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117	......
Edison Elec. Illg. Co. (Brooklyn)........	2,500,000	1,500,000	1940	....	111	112
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	..	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.

Date of Quotation—Oct 21 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
American Bell Telephone....................7s.			1898	F. & A.	101¾	....
Northwestern Telegraph Co................7s.	....	......	......	......	....	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.

Date of Quotation—Oct 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co....................	....	....	......	......	......	25
Barney & Smith Car Co.......................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co.......................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co..........................	75,000	......	......	......	....	

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12.30@12.37½c.; Lake, 12½c.; casting, 12¼@12½c.

The United States took formal possession of Porto Rico October 18.

The Columbus (O.) Street Railway Company has declared a dividend of 1 per cent. on its capital stock, payable November 1.

The Consolidated Traction Company of Pittsburg, Pa., declared a dividend of $1.50 per share on its preferred stock, payable November 14.

The Henry Worthington Company has declared a semi annual dividend on the preferred stock of 3½ per cent., payable on and after November 1.

The Dry Dock, East Broadway & Battery Railroad Company, New York, declared a quarterly dividend of 1½ per cent., payable October 20. Transfer books reopen November 2.

The Nassau Electric Railroad Company, Brooklyn, has been fined $100 for using soft coal at its power house in South Brooklyn, the courts having decided that the burning of soft coal there constituted a nuisance.

The present earnings of the Baltimore Consolidated Traction Company are reported to be at the rate of 6 per cent. The company now pays 4 per cent. per annum, but the rate is to be made 5 per cent.

The directors of the Sprague Electric Company, New York, have declared a semi-annual dividend of 3 per cent. on the preferred stock, payable November 1. Transfer books will reopen November 2.

The Hudson River Telephone Company has declared a regular quarterly dividend of 1 per cent., payable November 1. The company is reported to have earned $100,000 net in nine months of the present year.

A $40,000 mortgage has been filed in the county clerk's office at Rochester, N. Y., by the Lima & Honeoye Falls Electric Light & Railroad Company in favor of the Buffalo Loan, Trust & Safe Deposit Company.

A distribution of $2 per share upon the common stock of the Street Railway & Illuminating Properties was declared payable at the office of the company in Boston on the 22d inst. to holders of record at the close of business on the 19th.

The Staten Island (N. Y.) Electric Railroad Company reports for the quarter ended September 30: Gross earnings, $76,736, increase over the same quarter in 1897, $14,528; operating expenses, $38,107, increase $8,830; net earnings, $38,629, increase $5,698.

The annual meeting of the Pennsylvania Heat, Light & Power Company took place at Philadelphia on the 19th inst. As all the stock is held in trust by the Guarantee Trust Company to secure the Electric gold 5s, proceedings were perfunctory, the old board being re-elected.

At a meeting of the shareholders of the Royal Electric Company, Montreal, on the 18th inst., it was voted to increase the company's holdings of Chambly Manufacturing Company's stock from $200,000 to $300,000. The proposal to issue $500,000 preference stock of the Royal Electric Company was turned down.

The District Commissioners, Washington, D. C., have issued an order approving the issuance by the Columbia Railroad Company of $500,000 worth of bonds, under the recent act of Congress authorizing the company to extend its road eastward to the District line, by way of Benning, Deadwood and Watts Creek.

The Milwaukee Railway & Light Company has about completed a tunnel under the river, which will be used for carrying all feed wires for the railway and light system to the west side of the river, including the power for the Wauwatosa and Waukesha lines. Power will be furnished direct from the new power plant of the company now being built.

The United Electric Securities Company, Boston, has declared its regular semi-annual dividend of $3.50 per share on the preferred stock; also a dividend of $3.50 on the same stock, being the dividend due August 1, 1896, which has been until now unpaid. Both these dividends are payable November 1 to stockholders of record October 25. Transfer books reopen November 2.

It is estimated by the committee of the proposed new independent telephone company at Worcester, Mass., that the enterprise can be started for $165,000. The committee is composed of Henry F. Harris, William H. Barnes, E. P. Curtis, William Hart and Frank O. Plummer. The committee state that there is no connection between the new company and the People's Telephone Company.

The United Electric Light & Power Company of New York, following the example of the Edison Electric Illuminating Company, has issued a circular and arranged a new schedule of rates for lighting, heating, cooking and power purposes, adopting the three-quarter-cent basis for a 16 CP. lamp per hour as against the one-cent basis of the Edison Company. The latter will, it is expected, meet the undercut.

In announcing a semi-annual dividend of 3 per cent., payable October 31, the Exeter (N. H.) Street Railway Company states that the road had been in operation fifteen months, and shows a net gain of $9,148.17. The line will be extended soon to connections with Newburyport and Amesbury on the south, and with Portsmouth on the north, making one of the best suburban railroads in the New England States.

An interest in the Philadelphia Electric Storage Battery management, according to a current item, says that the company has done over $1,000,000 worth of business in the nine months of the present year as compared with the gross sales for the full year of 1897 of $959,000. The same authority states that the chances are good that the company will do at least $1,500,000 this year, on which net earnings of $500,000 ought to be shown.

dispatch to the Indianapolis "News" from Terre Haute says the holders of first mortgage bonds of the Terre Haute Street Railway (Russell Harrison's road) "will next month ask the judge of the Superior Court for permission to foreclose on their bonds because of default in the payment of interest. It is believed the court will grant the request. The property is in the hands of a receiver. It had been the intention of the bondholders to foreclose this month, but for some reason the step will not be taken until next month."

The $2,000,000 first consolidated mortgage 4 per cents of the Edison Electric Illuminating Company of Brooklyn, offered recently at 93½ per cent., were over-subscribed. The union of the Edison Company and the Kings County Electric Light & Power Company has now been perfected, only about sixty shares of the Edison Company remaining unexchanged. The interest charges of the Edison Company, including the consolidated mortgage bonds now issued, will be $155,000 per annum. The net income for the calendar year 1897 of the Edison and Municipal companies applicable to charges was $487,000.

The Boston "News Bureau" of the 24th inst. states that the directors of the General Electric Company on that day declared a dividend of $7 per share upon the old preferred stock and $11 1-5 per share on the new preferred. The New York "News Bureau" of the same date says: "The General Electric Company has declared a payment of 11 per cent. in cash on its preferred stock, representing part of the accumulated back dividends." The two statements are conflicting and we must await the official announcement to set the matter straight. It must be welcome news, however, to the stockholders that General Electric has at last declared a dividend of any sort, and we feel assured that these gentlemen will now duly appreciate the efforts made in the columns of ELECTRICITY for several years past to bring the company to its senses.

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EDITORIAL NOTES.

Another Reduction in the Cost of Electric Current.

The consumers of electric current in New York City are apparently about to reap the benefit of a competitive warfare. Some weeks ago we referred editorially to a new schedule of rates just issued by the Edison Electric Illuminating Company, and now their rival, the United Electric Light & Power Company, have gone them one better and reduced their rates to the ¾ cent basis. This reduction means that hereafter current will be supplied for incandescent lighting for 15 cents a kilowatt hour as against 20 cents a kilowatt hour now charged by the Edison Company under their new schedule.

These cuts in rates are undoubtedly the result of keen rivalry, although both companies claim that the reductions are due to the fact that at the present day, owing to improved apparatus, current can be supplied much cheaper than formerly. In any case the competition between these two electrical companies will unquestionably be felt by the gas companies, thus forcing them to take a hand in the warfare and likewise reduce rates.

On the one cent per hour basis an incandescent light is about equal in cost to gas at $2 a thousand. Electric light at ¾ cent per hour will be equivalent to gas charged for at the rate of $1 per thousand. The schedule recently issued by the United Electric Light & Power Company, however, places the cost of a light if used in excess of three hours at one-quarter cent per hour, which means that gas would have to be furnished at about 50 cents a thousand in order to compete with it.

The wholesale rate under the new schedule is ten cents a kilowatt for the first three hours of daily use and five cents a kilowatt for all use in excess of that time. Thus at ten cents a kilowatt a consumer would be paying the same as though gas were being used at the rate of $1 a thousand, whereas the price after the first three hours would about correspond to gas at 50 cents a thousand. The reduction in arc lighting is about on the same basis as incandescent, or 15 per cent lower than the former rate.

The plant of the United Electric Light & Power Company is comparatively small, having at the present time but an aggregate output of 15,000 horse power, the territory which it supplies extending from the Battery to 137th street from river to river. We understand, however, that arrangements are being made to increase its capacity from 15,000 to 27,000 horse power in the near future. As stated in our former editorial, it is the evident intention of the electric light companies, by the reduction in rates, to try and induce housekeepers to substitute electricity for gas, not only for illuminating purposes, but for cooking as well.

Where this rate war will end is hard to see, as it is now rumored that the Edison Company is contemplating a further reduction in its price for current to meet the recent cut of the United Electric Light Company. In any case, however, the consumers of either electricity or gas will probably be benefited.

* * *

Electrolysis.

Elsewhere in this issue will be found an article by Mr. A. A. Knudson entitled "An Electrical Survey in the Borough of Manhattan, New York City." This is the first time to our knowledge that a thorough survey of this nature has been made in New York, although other large cities, such as Boston and Chicago, have carefully examined into this important subject of electrolytic action set up by stray currents. Mr. Knudson's paper is well worthy of careful perusal by all those interested in the subj ct of electrolysis, and his tests made on the Brooklyn Bridge are especially interesting and timely in view of the discussion which arose last January as to whether or not sufficient current was finding its way to the metal portion of the structure to seriously affect the stability of the anchorages. From numerous and careful tests made, and from a careful examination of the plans of the anchorages, Mr. Knudson gives it as his opinion that the stability of the structure is not seriously threatened, apparently taking the same view of the matter as Electricity in an editorial of our issue of January 5.

The question as to whether cast-iron is subject to electrolysis is taken up by Mr. Knudson and ably discussed. He says:

"One of the bridge officials informed me that a certain authority had reported that electrolysis would not attack cast-iron, consequently their cast-iron anchor-plates were exempt from such danger. In the light of recent experience in other cities, that theory is now untenable."

He then goes on to quote from various reports showing conclusively that cast-iron pipe has been affected by electro'ysis in other cities. As may be recalled, this question as to whether cast-iron was subject to electrolytic action or not was brought up last February by the following statement of Mr. C. B. Martin, the electrical engineer of the Brooklyn Bridge:

"This insulation of the bridge is accomplished by the fact that the cables or connections of the bridge are fixed in the masonry at the anchorages, which are made of cast-iron. Cast-iron, as was shown by the exhaustive report of the subway commission,

which dug up pipes all over the city, is impervious to electricity."

We took exception to this statement, and in our issue of February 9 said:

"Mr. Martin's last statement regarding cast-iron would seem a rather curious one. It is unquestionably true that corrosion does not take place anything like so quickly with iron as, for instance, with lead, for while an ampere of current will dissolve in a year approximately 75 pounds of the latter metal, this same current will dissolve in the same space of time but 20 pounds of iron. Experience has shown, however, that cast-iron is by no means exempt from electrolytic action, and several photographs were exhibited at one of the meetings of the American Institute of Electrical Engineers a few years ago of cast-iron pipes taken from the ground at Milwaukee which were terribly pitted, and it was further stated that sections of this main had to be renewed, owing to electrolytic corrosion, three times in the course of two years."

We are glad to see that Mr. Knudson bears us out in our statement, as the Brooklyn Bridge officials appear to be still laboring under this delusion regarding the insulating qualities of cast-iron.

All sorts of remedies have been tried to prevent electrolysis, and only lately it was announced that a well-known engineer had invented a special generator which will prevent the escape of current, but in our opinion the solution of the problem lies in a greater expenditure of money to ensure an uninterrupted return, or metallic circuit.

* * *

Two New Systems of Telegraphy. Since Professor Morse transmitted between Baltimore and Washington the appropriate sentence "What hath God wrought" there have been innumerable improvements made in telegraphic apparatus. Some years ago it was found possible to transmit two, and later even four messages over a wire at the same time, known as the duplex and quadruplex systems. Devices of this nature are now in use in many telegraph offices and have justly been considered a giant stride in the development of telegraphy, enabling as they do a saving of both time and money. Two new systems are now however being experimented with which, providing they prove commercially successful, will mark another epoch in the history of telegraphy. One of these systems, known as the multiplex and invented by Professor Henry A. Rowland, will we understand shortly be given a trial between New York and Philadelphia over a line belonging to the Pennsylvania Railroad. By means of this device eight telegraphic messages may be sent over the same wire at the same time, four in each direction. This is accomplished by means of a keyboard at the transmitting end somewhat resembling that of a typewriter. The messages at the receiving end may either be recorded on a sheet of paper or upon a tape similar to that used in the ordinary ticker service. The advantages claimed for this system of telegraphy are, first, that no skilled operator is required at either end of the line, and secondly, that an enormous amount of time and money may be saved by transmitting eight messages simultaneously over the same wire. In a recent interview Professor Rowland is credited with the following statement: "There is no longer any question of the value and thorough utility of the machine, and many experienced telegraphers who have seen it work pronounce it absolutely perfect. An ordinary typewriter operator can send messages at the rate of forty words a minute, while all the time seven other messages are going over the wire, each separate and distinct from the others."

The other system previously referred to and known as the duodecaplex system was invented by a Frenchman, M. Mercadier, and is now being experimented with on an extensive scale over a line connecting Paris and Bordeaux. As many as twelve messages, it is claimed, may be simultaneously sent over the same wire by means of ordinary Morse transmitters. At the end of the line each operator is provided with what the inventor calls a monotelephone but which in reality differs little from an ordinary telephone receiver. The system is so arranged that each transmitter sends its message to its corresponding receiver, this being brought about by the use of interrupted currents. Each transmitter receives its current through a tuning fork having a special note, the vibration being maintained ele trically. These vibrations generate a current of the proper period, causing resonance at each application in the proper receiving circuit, which is adjusted for this especial period and no other. The signals are of course read by ear, little difficulty being experienced in so doing. The signals, it is alleged, divide up at the receiving end very perfectly, an operator at one receiver only being aware that other signals are being transmitted by an indistinct murmuring, not sufficiently loud to be bothersome.

Of the two systems, that invented by Professor Rowland would seem the best adapted for practical use, and certainly the most economical to operate, requiring as it does no expert telegrapher, and furthermore requiring at the most but one person at the receiving end, whereas the duodecaplex system would require at least twelve skilled operators. The development and practical application of these two systems will undoubtedly be watched with interest by the scientific world.

Under the Searchlight.

Notes and Comments on Various Topics.

THE St. Paul *Pioneer Press* publishes a certificate of amendment of the articles of incorporation of the Butte General Electric Company to the effect that the government of that corporation and the management of its affairs shall be vested in a board of not less than three, nor more than five directors, each of whom shall be a stockholder, and in the following officers, namely, a president, vice-president, treasurer and secretary, etc. To all of which our old friend H. M. Byllesby, being duly sworn according to law, on his oath saith that he, the said H. M. Byllesby, is president of the Butte General Electric Company, that he has read the foregoing certificate by him subscribed, and that the facts therein stated are true.

* * *

MR. NIKOLA TESLA has again alarmed his friends by announcing that he has discovered a means by which any amount of power can be transmitted electrically from its source to any part of the world without the use of wires, that is, by a system similar to wireless telegraphy. He asserts in a published communication that he has invented apparatus capable of generating electrical pressures vastly in excess of any heretofore used and that the current can be conducted to a terminal maintained at an elevation where the rarefied atmosphere is capable of conducting it freely; then at a distant point where the energy is to be used commercially to maintain a second terminal at about the same elevation to attract and receive the current and to convey it to earth through special means for transforming and utilizing it.

The difficulty with the recent extraordinary "inventions" of Mr. Tesla is that they do not seem to amount to anything more than astounding pen sketches and startling illustrations in the yellow journals. Several months ago we were told in double-leaded display type that Mr. Tesla had harnessed the sun and intended to erect a plant somewhere on Long Island to focus the solar rays and utilize them on a scale sufficient to turn all the machinery in the State of New York; then came the statement that he had gained control of the magnetic forces of the earth and could actually wobble the globe; following this was his discovery of a process by means of which man could make himself practically immortal, and to relieve him of the necessity of his customary ablutions he subsequently hit upon a plan to electrically cleanse the body without the use of water. These are but a few of Mr. Tesla's later exploits in the field of research that have found publicity in the columns of the press and have then passed into mist, and few will doubt that the last of his discoveries will prove anything more than the vagary of an overworked imagination.

* * *

AT the opening of the Brunswick Traction Company's new trolley line between Bound Brook and Plainfield, N. J., on the morning of October 29, the feature of the occasion was the running of the first car through Lincoln by Mrs. Emma Engel, president of the Borough Council. With her was Mrs. Flora P. Wrench and Mrs. Olivia Hazzard, also members of the council. On reaching the station at Lincoln, Mrs. Engel formally completed the line by driving a nickel spike into a tie. All this goes to show that the fair sex in that locality are apparently as expert in electrical and mechanical matters as in politics.

The General Electric Company's Dividend.

As we stated in our "Notes for Investors" last week, the General Electric Company has declared a dividend on its preferred shares, and the dividend is now officially announced as 11.66⅔ per cent. This is the first distribution on account of the accumulated dividends, which up to August, 1898, amounted to $1,527,885.33. The intention of the company is to pay the remainder of these accumulated dividends in installments and at the same time to pay the current dividends at the rate of 7 per cent. per annum on the preferred stock as reduced by a vote of the stockholders on August 17 of the present year. It is officially stated that the earnings of the company since the meeting at Schenectady in August last aggregate $500,000, and from this have been deducted debt and interest charges aggregating $150,000, leaving $350,000 available for dividends. The dividend of 11.66⅔ per cent., payable November 15, will require $297,640 for its payment, leaving due on the reduced preferred stock 48.22⅓ per cent., which must be paid before dividends are resumed on the common stock. The circular issued to the stockholders in which the dividend payment is announced says:

"Your board of directors has resolved to begin the payment of the unpaid accumulated dividends and the current dividends upon the preferred stock of the company. These dividends now amount to:

"1. Unpaid accumulated dividends amounting in the aggregate to $1,527,885.33 for the period commencing July 1, 1893, and ending August 17, 1898 (the date of the reduction of the capital stock), being dividends at the rate of 7 per centum per annum for the period named upon the par amount of the preferred stock prior to the reduction, namely, $4,252,000. As each share of the reduced preferred stock represents one and two-thirds shares of the preferred stock as the same stood prior to the reduction, the amount payable upon each share of the reduced preferred stock in respect of such unpaid accumulated dividends will be $59 89.

"2. Current dividends at the rate of 7 per centum per annum upon the par amount of the reduced preferred stock after August 17, 1898.

"Your board of directors has accordingly declared a dividend of $11.66⅔ per share on the reduced preferred stock, payable on and after November 15, 1898, to the holders of the preferred stock of record at the close of the transfer books on the fifth day of November, 1898. The amount of this dividend equals the unpaid accumulated dividends upon the preferred stock for the year beginning July 1, 1893, and ending June 30, 1894."

Meeting of the New York Electrical Society.

The 190th meeting of the New York Electrical Society was held at the Pearl street sub-station of

the Edison Electric Illuminating Company in Brooklyn on the evening of October 27. Two hundred and forty persons were present, each of whom on reaching the Pearl street station was presented with a programme informing him to which party and section he belonged. After an address by Mr. W. S. Barstow, in which the history and general evolution of the Edison system in Brooklyn was touched upon, the assemblage was divided according to their programmes into two parties, and each party into a number of sections, the latter being under the guidance of one of the Edison Company's employes. The first party then took trolley cars to the Union central station at Bay Ridge, returning by way of Station A, formerly known as the Citizens' station, while the second party first inspected Station A and then visited the Bay Ridge station. A collation was served to both parties.

Special cars were run to the New York end of the Brooklyn Bridge to accommodate the New York members, who reached the city shortly after midnight.

Through the efforts of Mr. George H. Guy and the courtesy of the Edison Electric Illuminating Company, and especially Mr. Edgar Allen Doty, the gathering was undoubtedly one of the most successful and enjoyable the Society has ever undertaken.

At the business meeting, which took place in the early evening at the Pearl street station, 30 new members were elected.

Proposals Invited.

The Bureau of Supplies and Accounts of the U. S. Navy Department is inviting sealed proposals until November 15, inst., for furnishing the Navy Yard at Portsmouth, N. H., with a quantity of electrical apparatus, including two 1,000 ampere single pole double throw machine switches; one 1,000 ampere Weston illuminated dial ammeter; one 150-volt Weston illuminated dial voltmeter; one ground detector switch; one 3-point voltmeter switch; two 500-ampere double pole double throw feeder switches; two 300-ampere double pole double throw feeder switches; four 200-ampere double pole double throw feeder switches; one double pole lightning arrester; one steam engine, to be of sufficient size to drive one direct connected 100 KW. generator at a speed of 250 revolutions per minute; to supply and install on the extended plate of the engine one 100 KW. dynamo of sufficient capacity to supply 100 KW. at 115 volts for ten hours without an increase in temperature in the armature, the dynamo to be of the multipolar type and compound wound; one 40 HP. motor; two 25 HP. motors; one 15 HP. motor, and one 5 HP. motor.

Prospective bidders desiring to bid on this important work can obtain detailed specifications, blank forms of proposals and other information upon application to the Paymaster General of the Navy, Washington, D. C., or to the Navy Yard at Portsmouth.

Meeting of the American Institute of Electrical Engineers.

The 125th Meeting of the Institute was held at 12 West 31st street on Wednesday, October 26, President Kennelly in the chair. A paper was read by Mr. A. A. Knudson on "An Electrical Survey in the Borough of Manhattan, New York City." The discussion was opened with a communication from William Maver, Jr., and continued by Townsend Wolcott, Jesse M. Smith and others.

The president announced that a Committee on Cooperative Research had been appointed in accordance with instructions from the council. The committee consists of Dr. A. E. Kennelly, chairman, Prof. W. A. Anthony, Dr. F. B. Crocker, Dr. C. T. Hutchinson, Dr. Samuel Sheldon, Chas. P. Steinmetz and Prof. E. Thomson. The purpose is to formulate a system of experimental research, by submitting to various colleges and universities various problems which are of practical importance. The investigations are to be made, as a part of undergraduate, graduate or post-graduate work, under competent supervision. The committee starts off with a list of sixteen subjects and will expect members to send in others which may occur to them in the course of their practice. The results when received, if deemed important, will be published in the Transactions. The plan is receiving hearty support.

At the meeting of the Executive Committee in the afternoon the following associate members were elected:

John McL. Murphy, Electrical Engineer Safety Third Rail Electric Co., New York.

F. K. Vreeland, Second Asst. Engineer Crocker-Wheeler Electric Co., Montclair, N. J.

J. E. Woodbridge, Editor *Electrical World*, New York.

The following associate members were transferred to membership:

C. H. Wordingham, City Electrical Engineer, Manchester, England.

William Stanley, Electrical Engineer and Inventor, Pittsfield, Mass.

AN ELECTRICAL SURVEY IN THE BOROUGH OF MANHATTAN, NEW YORK CITY.*

Showing Results of Stray Current Measurements Between Electric Railways, Underground Pipes, Etc., Also Results of Tests on the Brooklyn Bridge.

BY A. A. KNUDSON.

The corrosive effect of straying currents upon underground metallic structures is now so well known and understood that obviously there is no need to dwell upon this fact as a reality, but rather it is the purpose of the author to show from actual tests some of the locations and characteristics of the stray currents in New York City.

About eighteen months ago the question was raised by some of the municipal officers of this city as to the possibility of electric currents leaking or straying to underground pipes from the conductors of the "open conduit" electric railway on Lenox avenue, and adjoining streets at that time, as applications had been made to extend this system.

This matter was investigated at that time by the author, and some of the results becoming known to one of the officers of this Institute, he suggested that with some additional tests and the whole presented in a paper it would prove of interest to the members and perhaps throw further light on this interesting subject.

I have since made a number of additional tests throughout the city, from Harlem river to the Battery, between various metallic structures such as "L" (elevated railway) pillars, surface railways, water pipes, etc., and give the results here, trusting that they may prove acceptable, and possibly of some value.

Previous to making any tests on the Lenox avenue line, we had a well settled theory that in a double conductor system, as this is, very little if any of the current could be found diverted from the conductors to water or other pipes underground in its vicinity.

The tests were begun on Lenox avenue near the Metropolitan Company's 146th street power station, and continued south. From the first, unmistakable signs were encountered of railway current leakage from the rails of this road to both water and gas pipes, the sudden fluctuation of the voltmeter needle proving this beyond a doubt. It was noticed, however, that when a Lenox avenue car passed there was no advance of the needle as should be expected, and when two cars passed, going in opposite directions, there was no advance of the needle at the moment; continuing down the street and testing at each fire hydrant and gas post the voltage tended to increase upon nearing 135th street. The readings during these tests were as follows, the rails being positive to the water and gas pipes:

Location.	Water.	Gas.	Remarks.
145th street....	1/3 volt.	1/3 volt.	
188th "	2/3 "	1/6 "	
18[illegible]th "	2/3 "	2/3 "	
135th "	1/5 "	1/5 "	During this test no trolley car in sight on 185th st.
135th "	2/3 "		Test repeated when 135th st. overhead trolley car crossed Lenox ave. tracks.
125th "	1/2 "		
116th "	1/3 "		
109th " and Columbus ave.	1/3 "		

It was apparent from these tests that the most, if not all, of this leakage came from the Union Railway Company's line, operating the overhead trolley system, a branch of this road running through 135th street, and thereby crossing the rails of the Metropolitan Company's tracks at Lenox avenue. This seemed the more certain from the fact that the maximum reading (2/3 volts) was obtained when a Union Railway car was crossing the rails at Lenox avenue, or was quite near. Further proof, however, was necessary to determine if that company was responsible for all or only a portion of this current escape; advantage was therefore taken of the period when the Union Railway cars stopped running for the night, at 1:30 A.M., to make some further tests.

At this time there were no fluctuations of the needle whatever, and consequently no sign of a trolley current escape from the rails to underground pipes. Tests were made over the same route as during the day, as well as at other places, but although the Lenox avenue line was running (they have an all night service) no evidence could be obtained of current straying from those conductors to either water or gas pipes. What we did find, however, worthy of mention, was another current, emanating from an entirely different source, passing from the water pipes to the rails, the pipes this time being *positive*, which, as will be perceived, was the reverse of the polarity found during the day. This current was as perfectly steady as if from a galvanic battery. The difference of potential, however, was low; in some places one-thirtieth of a volt only was found, while in others the reading was two-thirtieths. In my efforts to identify this current I consulted the manager of the power station which supplied current to the Lenox avenue road, and he obligingly offered to shut down the plant for half an hour dur-

Location.	Day test, 9 to 10 A. M.	Night test, 1:30 to 2:30 A. M.
157th street........................	"L" + to Hydrant 7/30 volt.	7/30 volt "L" + to Hydrant.
149th "	"L" — " " 8/30 "	3/30 " "L" + to "
145th "	"L" — " " 6/30 "	1/30 " "L" + to "
140th "	"L" + " " 5/30 "	2/30 " "L" + to "
135th "	Rails U. E. Ry. + to "L" $2\frac{1}{4}$ volts.	2/30 " Rails + to "L" Ry.
135th "	" U. E. Ry. + to Hydt. 2 "	
135th "	"L" + to Hydrant 1/3 volt.	1/30 " "L" + to Hydrant. Night readings steady throughout.

* A paper read at the 128th Meeting of the American Institute of Electrical Engineers, New York, October 26th, 1898.

ing that portion of the night when traffic is the lightest and give me a chance to re-test. This was done between the hours of 2:30 and 3 A. M., when both of these electric roads were then shut down so that no possible current could come from either one. The same steady current was found, however, as before, passing from the water pipes into the rails. The

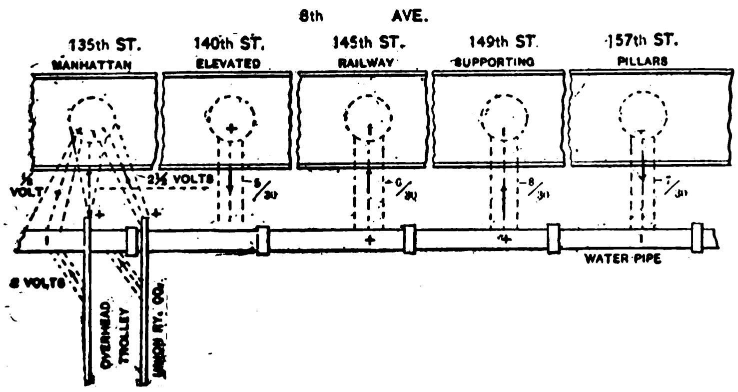


Fig. 1.

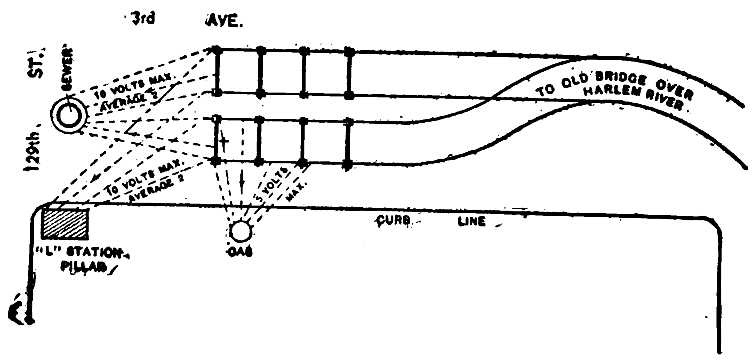


Fig. 2.

voltmeter proving insufficient as a means of completely identifying this current telephone receivers were used, and with one at each ear there was no difficulty in recognizing the familiar sing of the incandescent dynamo. This test with the telephone was repeated several times by my assistant and myself so that there could be no possi bility of error.

It appears from the tests made that an open conduit system, or one in which an insulated metallic return is used, effectually confines the current to the conductors provided for it. For this reason it is preferable to the ordinary ground return, especially in large cities, where the space below the streets is so largely occupied with various lines of iron pipes, more or less subject to electrolytic action.

The distances the overhead trolley current would sometimes reach were shown by a rise in voltage when a Union railway car crossed the tracks of the Lenox avenue road at 135th street. This was found as far down as 116th street, where the latter branches east and west; in fact there was no portion of this road where these trolley current fluctuations could not be obtained when cars were passing through 135th street.

Desiring to learn the difference of potential between the elevated railway pillars, and water pipes, with the Union railway, if any, in this part of the city, tests were begun at 157th street (Harlem river) on the Eighth avenue line and continued down as far as 109th street, which is the western terminus of the Metropolitan Company's open conduit system. Rather than make this paper monotonous with long tables of tests, some plans have been prepared of different locations in the city, showing where these tests were made, and giving the difference of potential at the points indicated. It may be well to state here that the voltmeter used was a Weston two scale; the lower scale reading to 5 volts with 30th divisions; this scale was used in most of the tests, and accounts for the record being given in a number of cases in thirtieths of a volt. The upper scale read to 150 volts in 1 volt divisions.

The following is a general description of the method of procedure, touching in detail at such points as may be of interest.

The starting point as already stated was at 157th street; from this point down to 135th street the tests are given in a table, as well as in plan, Fig. 1, the table giving both day and night tests for comparison while the plan gives the day tests only.

The Union railway (overhead trolley), heretofore spoken of as passing through 135th street, terminates at Eighth avenue; in fact the ends of the two trolley wires of that road are supported by being attached to the "L" structure, which as is well known passes through that avenue.

Referring to the table, it will be noticed that the reading at 157th street shows that the night test was the same as during the day. It was afterwards discovered that the last car of the Union railway had not then left the track, which accounts for this reading being higher than the other, as well as a trolley variation being shown. All of the other night tests, however, showed the same indications of an incandescent current as were found on Lenox avenue as well as at several other places. One feature worthy of notice in the day test, shown in the plan as well as the table, is the change of polarity found at different points on this section of the road.

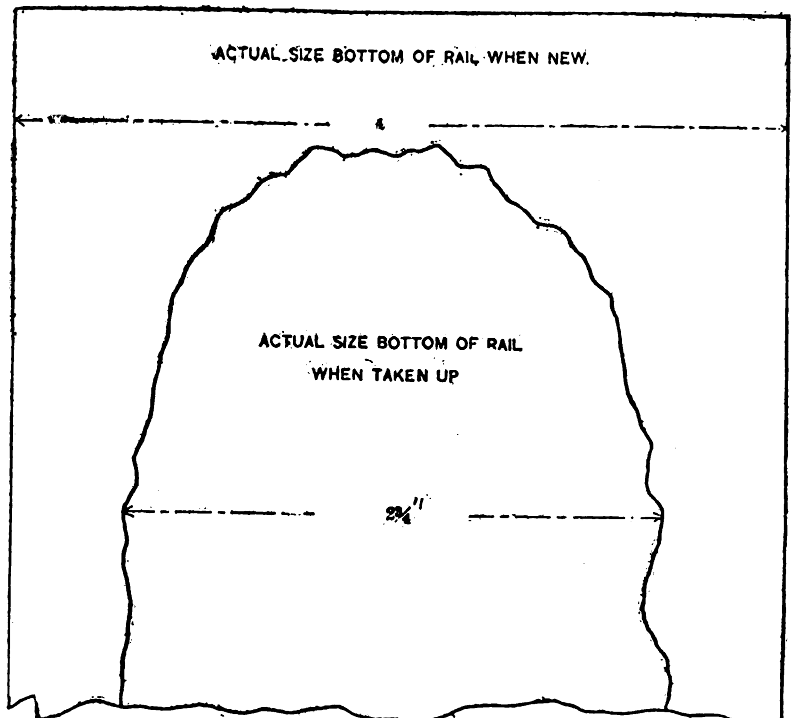


Fig. 3, Plan.

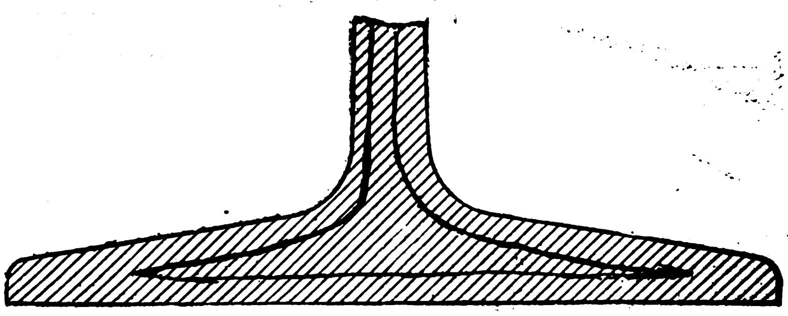


Fig. 3. Section

The current passes into the water pipes and "L" structure from the rails of the trolley road at 135th street (they being positive) from 2 to 2½ volts maximum, then along the pipes for five blocks to 140th street, then reverses and passes along the "L" structure for another five blocks to 145th street, where it again reverses and takes the water pipes to another reversal at 157th street.

The cause of this erratic jumping of the railway current up some pillars and down others may be explained in two or three ways, two of which I will mention:

1. Proximity of water pipes to the "L" structure, at some points being closer than at others, offering a more favorable path for this portion of the current.

2. The current passing into the water pipes at 135th street as well as the "L" structure at the same polarity, and possibly at a higher voltage at times to water, may cause this change in polarity at different points along the line.

A few days ago tests were made over this same section of road with almost identically the same readings in each case as prevailed over a year ago. It was noticed, however, that the terminal rails of the Union Railway Company at 135th street and Eighth avenue had recently been replaced by new ones, which appears to be a good illustration of "cause and effect."

Similar conditions also prevail on the section of road below 135th street down to 109th street. At this point the "open conduit" road has its western

terminus. Day tests have shown a maximum reading of one-third of a volt, the rails being positive to the "L" pillar and to water, the night test when Union railway was not running two-thirtieths steady, showing plainly that the current was from that road.

Attention is now directed to the east side of this part of the city where another branch of the Union railway is located. Tests made here show even more pronounced results than at the branch running through 135th street to the west side. It may be stated that the power station of this road is located on the Bronx river in Westchester County.

Something more than a year ago when these tests were made, this branch had a terminus at Third avenue and 129th street, immediately in front of the "L" station, the cars then passing over the Harlem river at the old wooden bridge, which is now being removed. The cars now pass over the public bridge recently opened, to the new terminal at Lexington avenue. Fig. 2 shows the location of the terminal when these tests were made, as well as the difference of potential.

It will be noticed that the maximum reading here was 10 volts, rails positive to "L" pillar, sewer and gas. A test was also made on the Harlem bridge

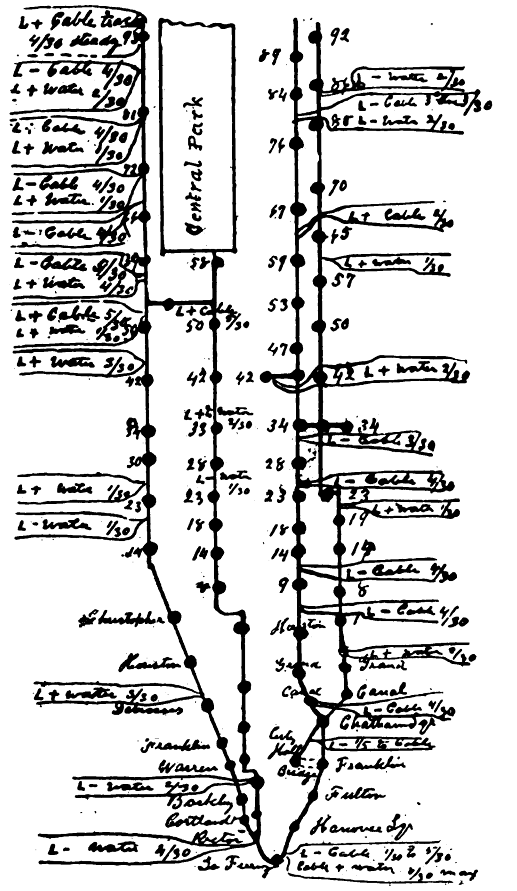


FIG. 4.

which showed the same reading, except it was made to gas only, no other pipes being at hand. A few days ago this locality was visited with a view of obtaining any further items which might be of interest for this paper, and workmen were found engaged in removing the rails of this very terminal.

Information was therefore obtained as to the results of electrolytic action on these rails (they having been positive). An impression was taken on paper of the exact size and shape of the end of one of the four rails which composed that terminal switch, the ends of the other rails all being in just about the same condition. Fig. 3 shows a comparison of the size and shape of the rail when new and its present condition; the position of the outlines as to each other being about as shown. From the condition of these rails now, it is quite plain that a large amount of metal has been removed from them by electrolysis. The original size of the rails was furnished by the company supplying the rails, they being about 70 lbs. to the yard; furthermore, the bottom sides of all these rails were cut by the current down to knife edges for several feet back from the ends. These edges were irregular in shape and somewhat jagged in appearance.

Another feature of interest is the condition of the cross-bars or tie-rods which keep the rails in position.

These bars, which were originally $1\frac{1}{2}''$ wide by $\frac{3}{8}''$ thick, were nearly all so eaten away that the middle portion was missing, the ends protruding from the rails at from 6" to 12".

Further tests were made in this part of the city, but being not specially important are omitted until 93d street is reached, from which point to the Battery a plan is given, showing the locations where tests have been made, their voltage and polarity. These tests refer mostly, as you will notice, to the incandescent current, passing at low voltage, ranging from 1-30 to 1-5 of a volt. One feature worthy of attention is the lowest reading being generally found at the "L" stations, between pillars under the stations and water pipes. This is accounted for by the fact that as there are water pipes supplied to most if not all the "L" stations they would make a fairly good electrical connection with the structure itself, and therefore not much difference of potential could be expected. This point also suggests a method for remedying this condition of affairs. Coming down the west side of the city, I was surprised to encounter a full fledged trolley current in the extreme lower part of the city. The first intimation was found at Rector and Greenwich streets; it became more pronounced in the vicinity of South Ferry where in testing between the rails of the Metropolitan cable road and an "L" pillar a variation of from 1-30 to 8 30 volts was found, the rails positive, and the same reading between the rails and water pipes.

Just why there should be indications of a trolley current in this part of Manhattan Island was difficult to understand, but after making further tests coming up on the east side this current was found to come from the Brooklyn bridge. Having pointed out how an overhead trolley using the water pipes and incidentally the rails as a return, such as is operated on 135th street, can spread its influence, so to speak, for a distance of over twenty blocks in either direction north and south, through various pipes, railway structures, etc., the existence of this current from the bridge permeating underground metals through a large portion of the lower part of the city is accounted for.

The tests were continued at the New York entrance of the bridge, at the pillars which stand in the street just west of the Third avenue cable railway I found the readings as follows: At one pillar a maximum of 3 volts, average $1\frac{1}{4}$ volts, pillar positive to Third avenue cable rails. At another, practically the same reading. Further up Park Row, at the corner of Chambers street, pillar positive to cable rails, 1 volt maximum; water positive to cable rails, $\frac{1}{2}$ volt; pillar positive to water, $\frac{1}{5}$ of a volt.

All of these tests were made nearly a year and a half ago. A few days ago tests were made over this same ground, and at places where a difference of potential of 3 volts maximum existed at that time it is now found to be 3 1 5 volts, pillars positive as before to rails of Third avenue cable and also to water pipes, showing in all probability that this current has been during all this time actively and unceasingly passing down the pillars which support the "L" station at this place, as well as the bridge crossing the street, and out from their foundations to other metals, as stated, with now a fifth of a volt more for good measure.

In the light of present knowledge on this subject the very serious question presents itself to any practical mind here present, in what condition would we expect to find the anchor bolts and iron foundations of these pillars if excavations were made at their base?

In Mr. Farnham's excellent paper read before this Institute four years ago, he showed that but a small fraction of a volt was necessary to establish electrolytic action between metals.

What then can be expected from an incessant action of from $1\frac{1}{2}$ to 3 1-5 volts jumping out of these foundations during the past year and a half or perhaps two years?

Further tests at the New York entrance of the bridge at pillars nearest the four loop tracks show that they are negative to rails of these tracks with maximum voltage of $3\frac{1}{4}$, an estimated average of $2\frac{1}{4}$. These tests were made on three different days at different times of the day, the highest maximum reading as above being taken at 4:45 P. M. The other tests were made during the so-called rush hour between 5:30 and 6 P. M., where a maximum reading of 2 1-5 volts noted at track 1 did not vary much from the tests made another day at from 2 to 2:30 P. M. at track 4, where the voltage was found to be $2\frac{1}{2}$ maximum. Previous to any use of electricity for operating cars on the bridge it had been

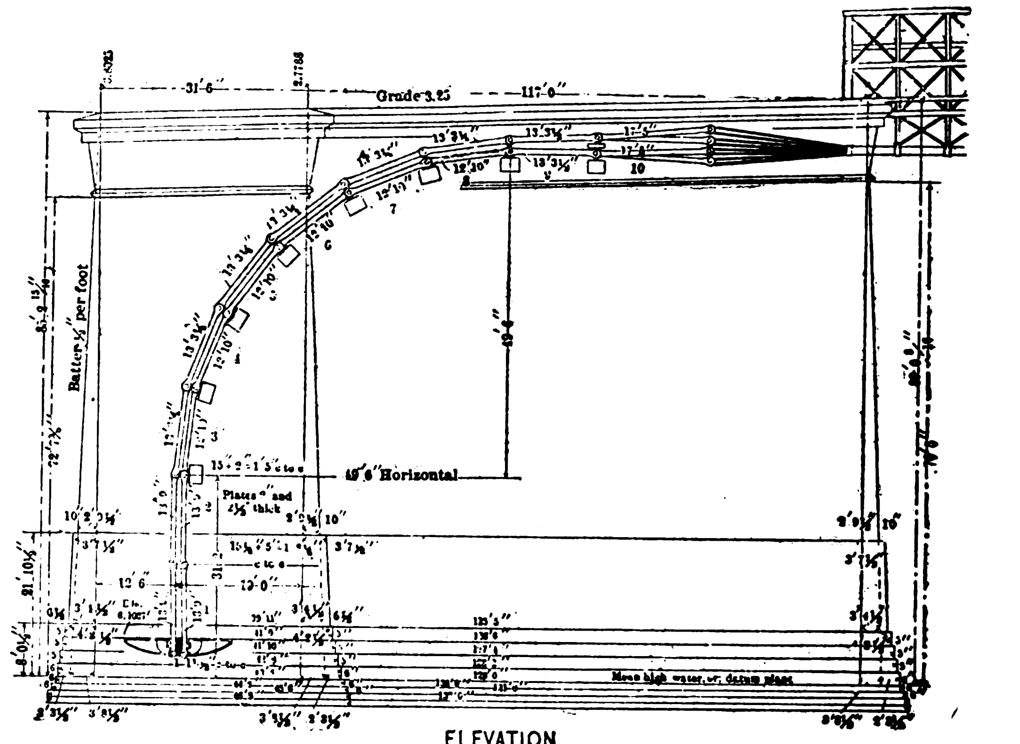


FIG. 5.

known that currents were escaping to that structure from trolley lines in Brooklyn, and passing over would find their way through the city by underground pipes, etc., and thence crossing the river arrive back to the power station in Kent avenue.

The polarity of both of these railway systems now operated on the bridge indicates that these currents escape from their lines, but it is also quite likely that currents are even now coming over the bridge as they were a year ago. Only an extended investigation would determine these points, even if it were desirable that they should be known.

Let us now take up the investigation made on the bridge to determine if possible the movements of straying trolley currents and their possible effect on the cable terminals. In view of the importance of this matter I regret not being able to make it more thorough than here stated, as it would involve not only a fortnight's work at least, but the shutting down of the bridge plant for a time, which could hardly be expected under the circumstances. Such facts are represented however as it was practicable to obtain. Recognizing the necessity of having every detail as to the construction, location, etc., of these

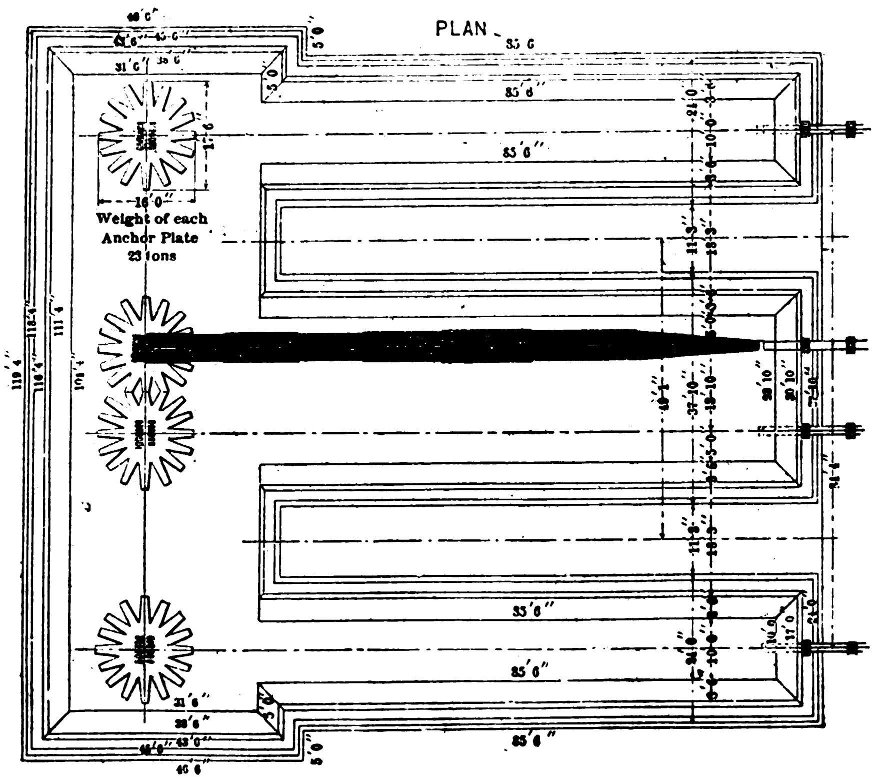


FIG. 6.

terminals before being able to intelligently consider the matter, plans prepared by the bridge engineers were obtained which are given in Figs. 5 and 6. These show the exact construction of the cable terminals and anchor plates, besides other information regarding construction, all of which is from an official source.

In regard to the construction of the cable terminals: as most of us know, the main cables are made up of eighteen strands, or smaller cables, which are practically continuous, the wire running back and forth from New York to Brooklyn, passing through the holes at the ends of heavy steel bars or links at each place, and the ends of the single wire being finally fastened by a rigid screw coupling. These two rows of steel bars of nine each, which are attached to the cable strands, one row placed over the other, as shown in Fig. 5, pass down with a graceful curve into solid stone masonry to the anchor plates, and are secured to them by heavy steel bolts passing through the eyes at the ends, as shown in the figure. The anchor plates are in shape somewhat longer one way than the other (see plan), each being a single piece of cast-iron weighing twenty-three tons.

(*To be continued.*)

ON THE TRANSMISSION OF POWER BY TWO AND THREE PHASE CURRENTS.*

BY ANDREW STEWART.

The subject of power transmission by means of polyphase currents has of late been receiving a great deal of attention and has led to the discussion of the relative merits of two and three phase currents for that purpose.

The subject may be divided into two divisions—(1) The transmission and distribution of light and power in cities; and (2) in factories. The first case may again be divided into two sub-divisions—(*a*), the transmission of energy from a central station to a number of sub-stations containing rotatory converters, converting the alternate current to a direct one, feeding a low tension network for lighting or traction; (*b*), the transmission of energy from a central station to a number of transformer sub-stations, feeding a low tension alternate current network.

The case of many large cities would be met by—(*a*) where they are already equipped with low tension direct current plant, which is in many cases outgrowing the limited amount of ground available in most cities; while (*b*) more nearly represents the present single-phase system of distribution, with which many provincial towns are equipped. The only difference is that the system, being multiphase, a large motor load could be carried.

The question is, under what circumstances is it desirable to choose a two or three phase system?

That both are successfully supplying light and power does not mean that they are equally suited to the purpose, and it is the object of this short paper to consider both systems as nearly as possible on their merits.

In Europe the three-phase system seems to get the preference. Although two-phase plants are in operation, they are not so numerous as three-phase; while in America both two and three phase systems are very numerous.

The advocates of three-phase currents state that by that system, as applied to motors, a more uniform turning effort is secured, and the power factor is higher. While the former may be conceded, it may be pointed out that the turning effort of two-phase motors is uniform enough for all practical purposes. As for the latter statement, it is open to considerable doubt. It is true that one prominent European manufacturer of polyphase machinery shows a slightly higher power factor (about 2 per cent.) for three-phase machinery. But a well-known American firm shows the same power factor for two as for three phase plant, and there seems no theoretical reason for any difference in their power factor.

The chief disadvantage of the three-phase system is its liability to become unbalanced, due to unequal loading of any of its two sides. This may be met by taking the same care in arranging the lamps as would be taken on an Edison-Hopkinson three-wire system, or by using a special balancing transformer. However easy these remedies may seem, it is admitted that in large cities serious unbalancing may occur. The experience of many three-wire systems in large cities is not by any means reassuring to anyone who proposes to use three-phase distribution. Owing also to the three circuits being electrically interlinked, it is impossible to control one phase independent of the other. Thus the application of the three-phase system seems to be confined to simple power distribution in large units, or to any purpose where the current may be kept approximately the same in all three lines, thus meeting the requirements of case (*a*) to a very large extent.

The necessity, however, for maintaining a fairly well balanced line renders it unsuitable for the general distribution of light and power.

Two-phase seems to present many advantages, especially where single-phase is already installed, as it is easy to feed a single-phase network, as such, from a two-phase generator; there is also an entire absence of balancing troubles, as a two-phase generator may be run with one phase fully loaded and the other half-loaded, with scarcely any variation of the pressure, while even this may be eliminated by regulation. The ease with which one phase may be controlled independent of the other renders it extremely useful in supplying a mixed system of light and power, as in such cases it would be practically impossible to get the load equal on both phases. Nearly all the regulating devices used on single phase may be used on two-phase, thus rendering easy its introduction into places where single-phase is already installed. Indeed, two-phase seems to give all the advantages of multiphase distribution, with the flexibility and ease of control so characteristic of single-phase, thus meeting the requirements of case (*b*).

In factories where the distribution of light and power by polyphase currents has been coming to the front of late, there seems in many cases little to choose between two and three phase currents. In most cases a large motor load has to be supplied, and, as the lighting load goes on and off with fair regularity, and is generally under the control of the engineer in charge, unbalancing troubles are not so much to be feared. Thus three-phase seems to meet all requirements. In numerous cases, however, electric welding has to be considered, and as it is desirable, wherever possible, to use only one type of plant inside a works, the suitability of the generator to supply current for welding transformers is important. Here two phase scores decisively. It is a matter of no difficulty to supply a welding transformer from one phase of a two phase generator, while to do the same from a three-phase generator would be to upset the balance of the entire system, causing lamps on one side of the network to burn dim, arc lamps to flicker, and a general derangement of the entire system.

One important point should not be overlooked—that is, cost of copper. This is greatly in favor of three-phase, while, on the basis of maximum stress on insulation, the direct current, three-wire system is most advantageous.

Although, as will be seen, three-phase has such a large advantage over its rivals, in the matter of cost of copper this does not have much influence in the case of power transmission in factories, where the cost of copper seldom exceeds 30 per cent. of the total cost, and, when compared with flexibility and ease of control of two-phase, it will be no great advantage to give three-phase the preference, except where very large amounts of power must be transmitted.

It will be seen from the foregoing remarks that both two and three phase systems have distinct merits of their own, and in course of time will each have their own position in the engineering world.

Meanwhile, I hope that these remarks will serve to clear up any misunderstanding relating to the important subject of power transmission by polyphase currents.

* From *Electricity*, London.

DIESEL'S RATIONAL HEAT MOTOR.*

BY E. D. MEIER.

(*Concluded from page 248.*)

I have just received a paper from a noted Austrian engineer, Mr. Emil Krause, written after a careful personal inspection of the Diesel motor at Augsburg. Mr. Krause is known beyond the limits of his own country as an expert on boiler construction and boiler management, and his position is such as to qualify and bias him rather as a champion of the steam engine than otherwise. Thus, when I quote his conclusions, I am giving you the convictions of a man whose interest is, if anything, inimical to Mr. Diesel, but whose professional integrity compels him to acknowledge excellence where he finds it:

"I saw such a motor at work in the Augsburg Machine Works last fall, and must state that it impressed me as a completely designed and finished machine.

"(1) The working process, such that heat is supplied only at high temperatures, fills the requirements of a rational heat motor better than any previous heat engine.

"(2) The temperature at which the addition of heat begins is entirely independent of the process of combustion, and is so high that the efficiency, even when a minimum of heat is supplied, cannot fall below that fixed by this initial temperature.

"(3) The influence of the temperature of combustion on the thermal efficiency is so small that within certain limits this efficiency actually increases with the excess of air in which combustion is effected.

"(4) The regulation of the motor can be consequently accomplished without affecting its economy.

"The first petroleum engine embodying these principles has placed the Diesel motor at the head of all petroleum motors up to date. The same success is probable for the Diesel gas engine; work on this is progressing, and everything indicates that a new success for Diesel will shortly be recorded."

It was Diesel's first intention to build a motor with three cylinders embodying compound compression and compound expansion, and one of this type has been built at Augsburg, and is to be thoroughly tested on producer gas. But the development of the single-cylinder type has been so satisfactory, and the demand has become so great, that at present the German shops are busy to their fullest extent building this simpler form. As this form has reached an absolute efficiency of 30 per cent., and is in every way a simple and practical machine, there is at present no reason for developing the compound motor. The cut here given (Fig. 1) represents the first of these 20 horse-power motors, built by the Nürnberg Machine Works. In appearance it resembles a vertical marine engine; a strong base-plate supports the the main journals of the crank-shaft, outboard bearings being provided for the shaft extensions which carry the fly-wheel and pulley. Bolted to the base-plate is a stout A frame containing the guides. In the rear leg of this frame, a small air-pump is supported. On top of the frame is placed a cylinder open at bottom. Its top is closed by a head cast in one piece, in which are contained one suction valve for air, one discharge valve for spent gases, and a needle valve for the fuel. The admission to the casing of this fuel valve is controlled by a stop valve which can be instantly closed to shut off the supply of fuel. Besides this, there is a starting valve used only in starting the engine. Cylinder and air-pump are water jacketed. This water jacket was not used in the earlier experimental engines, but is found advantageous in keeping the temperature of the working parts uniform. As the temperature of combustion is so much lower than that of the explosion type of engines, a much smaller amount of water suffices for this. In the earlier German engines, the main shaft and crank are bored for water cooling. This, however, grew out of the practice of Krupp's Steel Works of boring all small shafts produced. The practice has been discarded in England and in America as unnecessary. The air-pump is driven by a set of levers attached to the main cross-head. Conveniently placed to one side is an air vessel, known as the starting tank, connected by copper pipe to the air-pump, and to the fuel valve casing.

The operation is as follows: On one down-stroke the main cylinder is completely filled with pure air, the next up-stroke compresses this to about 35 atmospheres, creating a temperature more than sufficient to ignite the fuel. At the beginning of the next down-stroke, the fuel valve opens, and the petroleum, atomized by passing through a spool of fine wire netting, is injected during a predetermined part of the stroke into this red-hot air, resulting in actness. In this regulation resides a great advantage for the Diesel motor. The full charge of air being always supplied for complete combustion, it matters not whether the governor permits one or fifty drops of petroleum to enter the working cylinder at each motor stroke, the combustion is always complete. Thus variations in excess of air over that theoretically necessary from 26 to 116 per cent. have been measured, and the analysis of the spent gases shows no trace of unburnt carbon or hydrogen. It is hard to conceive a more perfect combustion than that which takes place when fuel is sprayed, finely powdered or atomized into red-hot air just beginning to expand. To stop the motor it is only necessary to close the valve which admits the petroleum into the fuel valve casing. The valve gear consists of a series of cams placed on a shaft journalled on brackets cast on the cylinder.

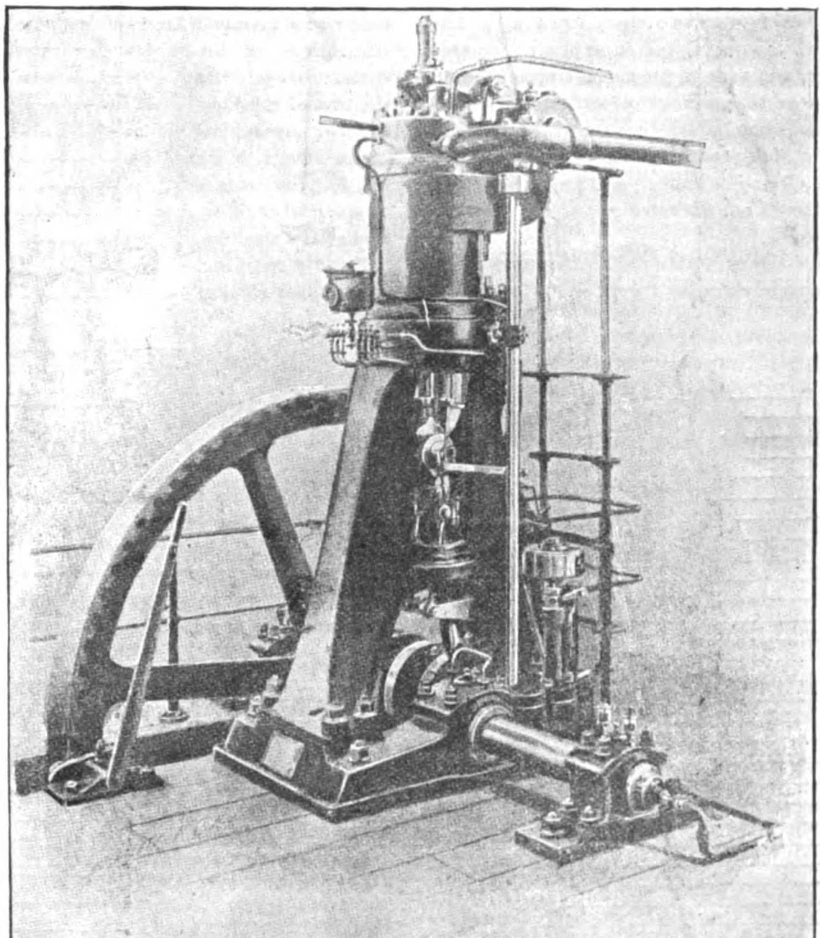


FIG. 1 —Diesel Motor—Perspective View.

combustion controlled as to pressure and temperature. This injection is made possible by the air in the starting tank, which is kept by the small air-pump at a pressure some 5 to 10 atmospheres greater than that in the main cylinder. A small quantity of this air enters with the fuel charge, which it atomizes as described. When the motor is running at full load, a very small quantity of injected air suffices, and the pressure in the air tank steadily rises. At half load, with less fuel injected, more air passes in. For this reason, the starting tank is made large enough to equalize these differences, and a small safety valve is provided on the air-pump.

The petroleum is pumped into the fuel valve casing by a small oil pump bolted to the base-plate. This pump is arranged to pump a fixed maximum quantity of petroleum. A by-pass is provided so that this whole quantity or any portion of it can be returned to the supply tank. The governor controls the action of this by-pass valve, closing it just long enough to compel the exact quantity of the fuel required to pass into the fuel valve casing. As this requires only the movement of a small light wedge the regulation is accomplished with great ex-

In starting the motor a hand lever is pulled to one side throwing all these cams, except the exhaust valve cam, out of gear, and throwing a special cam into gear with the starting valve. A few strokes of the petroleum pump by a hand lever inject a small quantity of petroleum into the fuel valve casing. The fly-wheel is thrown over by a lever a trifle beyond the upper dead point. The fuel throttle valve is opened, and by a turn of the hand-wheel communication is established between the air tank and the starting valve. A single charge of highly compressed cold air enters the cylinder, sufficient to give two revolutions of the fly-wheel at moderate speed. At the close of the first revolution the starting valve cam is automatically thrown out and the other cams into gear, thus on the second revolution a full charge of air is drawn in and compressed, and in less than thirty seconds the motor is running at full speed.

It will be noted from Lord Kelvin's clear analysis of the working process of the Diesel engine that Mr. Diesel makes a sharp distinction between the temperature of ignition and the temperature of combustion; the first is a constant value at each pressure

* From the Journal of the Franklin Institute for October.

and dependent only on the physical qualities of the fuel—the higher the pressure the lower the temperature of ignition. The temperature of combustion on the other hand is variable, depends on many conditions, and especially on the quality of the air by which the combustion is maintained, but it is always higher than the temperature of ignition.

Diesel's radical departure from all previous practice is in generating a combustion temperature by mechanical compression of pure air, utilizing this temperature to ignite the fuel, and by so introducing the fuel that the heat lost by expansion is practically balanced by the heat added by combustion.

Before the completion of this perfect engine certain critics of Diesel's theories contended that the dimensions of the cylinder and all other working parts would become so great as to make it impracticable to build such engines. But in Diesel's engines the increase and the decrease in pressures are so gradual that there is no shock. The change from one to the other is always accomplished at a dead point. In all motors relying on explosion for their moving force, and even in the steam engine, there is a direct blow at the moment of ignition or admission. I present here a drawing on which indicator diagrams of a high-pressure steam engine, of an explosion-type oil motor and of a Diesel motor have been drawn based on the same piston displacement (Fig. 2).

Diesel's and the explosion-motor diagrams can be directly compared since both work on the four-stroke cycle. The steam-engine diagram should be quadrupled. This disposes of the objections just referred to.

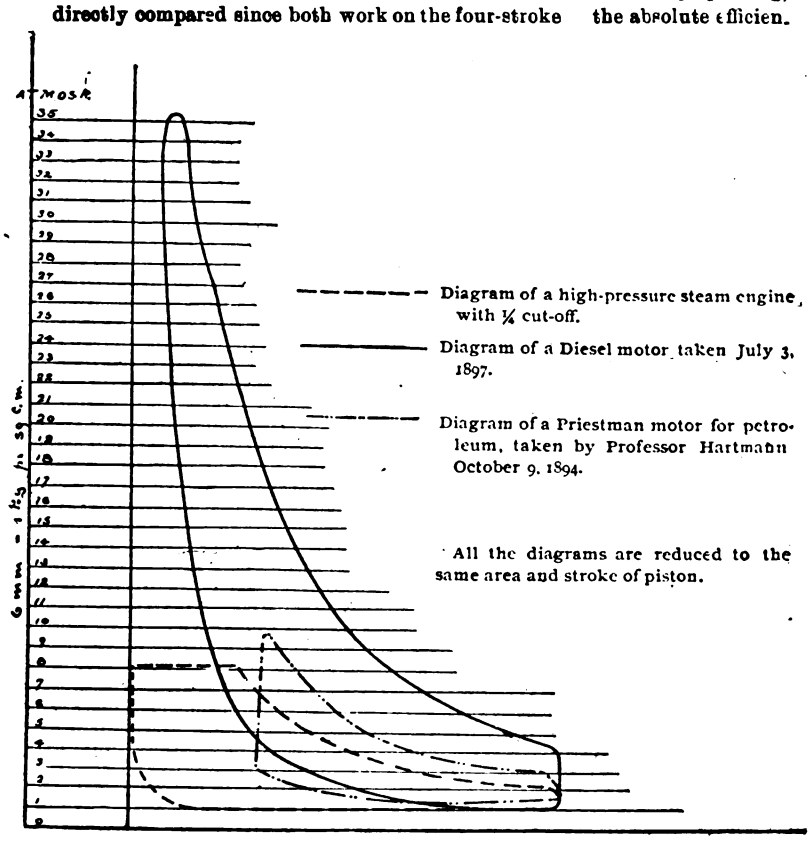


FIG. 2.—Comparison of diagram of a Diesel motor with diagram of a steam engine and of an explosion-motor.

These second and third diagrams (Figs. 3 and 4) are graphic comparisons of the Diesel motor with a number of the best petroleum motors as to economy in fuel and volume swept by the piston per second. They are given on the authority of Prof. Hartmann, well known as a careful and conscientious observer in this field.

The abscissæ represent piston displacement in liters per second, the ordinates petroleum consumption in grams per hour, both figured on the effective or BHP. The full lines (Fig. 3) embrace the results for full load, the dotted lines (Fig. 4) those for half load. The comparison is between engines which burn ordinary safe lamp petroleum or kerosene; results obtained on benzine or naphtha are not considered, since motors depending on such dangerous fuels can never be generally adopted for industrial purposes. The calorific value of these highly inflammable and explosive liquids is no greater than that of safe kerosene or of fuel oil.

You will notice that we find the Diesel results in both cases near the apex of the angle. Or, plainly put, both at rated capacity and at half load the Diesel motor shows the smallest cylinder dimensions and the least expenditure of fuel.

Remember that the others represent the best results from engines carefully developed and improved in all mechanical details, while the Diesel motor is but the third one ever built, and that in its construction the practical realization of the theoretical cycle was the primal consideration, mechanical improvement being left for the future commercial exploitation of the machine.

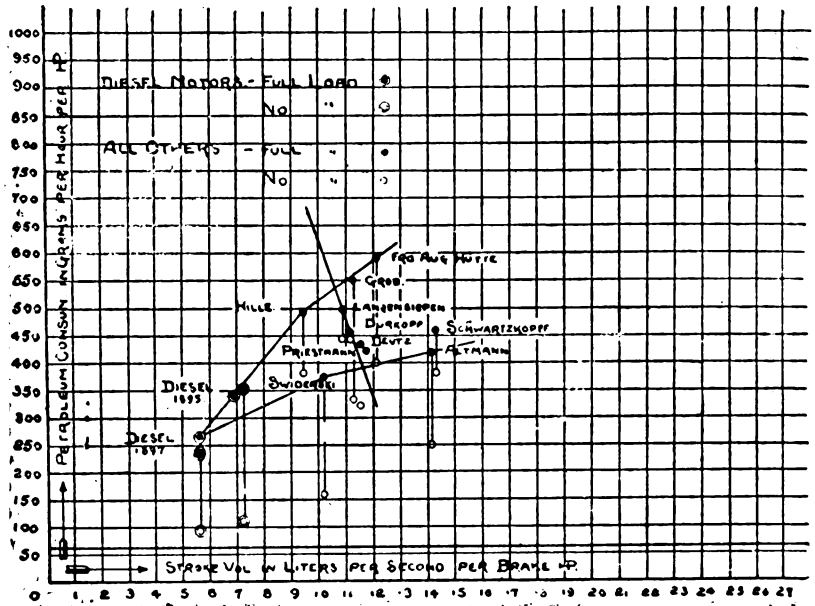


FIG. 3.—Graphic comparison of the performance of Diesel motors and best previous types of (explosion) oil motors.

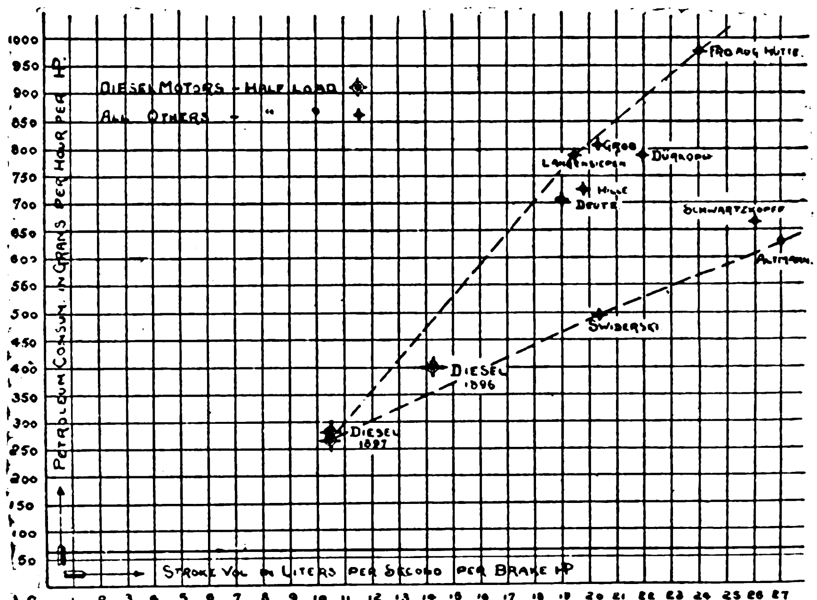


FIG. 4.—Graphic comparison of the performance of Diesel motors and best previous types of (explosion) oil motors.

Broadly speaking, the absolute efficiencies of the best-known heat engines of to-day range about as follows, taking into account actual calorific values of the fuel and effective or brake horse-power:

	Per cent.
Small auxiliary steam engines, pumps, etc.	.6 to 1
Plain slide valve engines in good condition	3 to 5
Single-cylinder Corliss engines	6
Compound-condensing engines	8
Reheating-compound or triple-expansion steam engines	12
Best oil engines (explosion type)	16
Best gas engines (explosion type)	19
Diesel motor	28 to 30

All these are compared when running steadily at full load or rating at point of best economy.

But in a large majority of the applications of all these prime movers the exigencies of the service require them to be run frequently at three-quarters and at half load for a large part of their daily service.

It is conceded that in most engines the internal frictions or mechanical losses are a fixed amount, so that a loss of 15 per cent. at full load becomes 30 per cent. at half load. And thermal losses increase even more rapidly; for instance, in steam engines by cylinder condensation. In gas and oil engines the absolute efficiencies have in some cases shown measured loss of nearly 60 per cent. In the Diesel motor the thermal efficiency is shown to increase with decreasing loads, thus counteracting in a marked degree the loss in mechanical efficiency which it shares with the other machines. From a number of carefully-checked tests, I found the average drop in absolute efficiency from full to half load to be only 12 to 13 per cent. in the Diesel motor.

So promptly and easily does it respond to a change of load, that a sudden addition of 30 per cent. to the electrical load on the Diesel motor at the Electrical Exposition at New York, by the throw of a switch, was not noticed by observers of the engine or the lights, though promptly registered by the ammeter.

For variable loads, then, the Diesel motor will show in practice a much greater superiority over all rivals than that apparent from the tabular figures just given.

The Diesel motor has been fully developed as an oil engine. At first it was tested only on ordinary lamp petroleum, such as is used in every household.

But in November last I sent a barrel of American gas oil and four barrels of American fuel oil to Augsburg and Nürnberg, to make conclusive tests in regard to its reliability and economy on those cheap fuels. A series of tests was made, which gave the gratifying results that the economy was the same as on refined petroleum, and the combustion so complete that no fouling of cylinder, valves or exhaust-pipe occurred.

Encouraged by this, the German factories made tests with a cheap fuel oil, distilled from bituminous shale, and called "Solar Oil" in Germany. The result was so satisfactory that motors have since been sold guaranteed to run on these cheap oils, and they are doing this with perfect satisfaction.

American fuel oil is sold, delivered on track in tank cars and tank wagons, at prices ranging from 1.6 cents to 2 cents per gallon in the West, and from $2\frac{1}{2}$ cents to 3 cents in the East; based on these prices, and allowing the high average of 240 grams per BHP. hour, a 100 horse-power Diesel motor will consume about 15 cents' worth of fuel per hour. With coal at $2.80 per ton, the fuel cost per hour for 100 BHP. in a good steam engine will be about $54\frac{1}{2}$ cents for a slide valve, $43\frac{1}{2}$ cents for a Corliss, and 22.4 cents for a triple-expansion engine, and to this should be added a fair proportion of the fireman's wages, and for coal-passing and ash-hoisting, none of which charges would be incurred where the Diesel motor is used. Weighing all these facts, it becomes easy to understand the wonderful and unprecedented progress made by Diesel's invention in Europe.

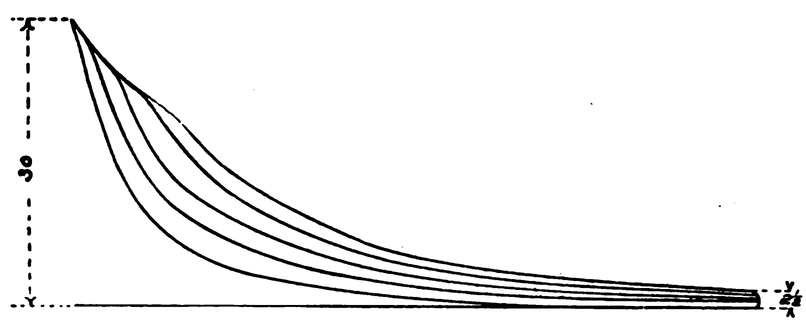


FIG. 5.—Diesel motor used with gas-indicator diagrams when regulating ½ millimeter = 1 kilogram = 14·7 pounds.

Up to date he has licensed sixteen large machine shops to build his motor, and a conservative estimate of the amount of capital now specially devoted to this work in Europe places it at between four and five million dollars. The invention comes to our shores, not, as so many do, in its experimental stage, but in a complete form, so far as stationary motors are concerned. Designs for railway, street car and marine motors have been made in Germany and England, and they will probably have passed through their experimental stage by the beginning of next year. The adaptation of the stationary motor to gas is practically completed, and a progressive series of tests on various kinds of gas will be run in Augsburg during the summer.

I take pleasure in presenting an enlarged view of an indicator diagram (Fig. 5) taken from the motor while running on Augsburg city gas, merely to show you that the same beautiful and economical cycle is possible with gas as with petroleum.

The work of experimenting, developing and testing has been performed with proverbial German thoroughness. American methods of manufacture, with special tools, gauges and templates arranged to turn out a large number of duplicates of each size, will soon bring the motor into general use in the United States. To do this the same broad policy of dividing the work among a limited number of first-class and well equipped manufacturers, which works so well in Europe, will be adopted here.

The freedom from smoke, ashes, soot, etc., the absolute immunity against explosion, the great saving in space, in labor and in fuel, will soon bring this rational heat motor into general use in our large cities, at first for small and medium powers, but gradually for far larger ones; and it is my opinion and firm belief that, before the end of the century, the name of Rudolf Diesel will be written on the same scroll with that of James Watt.

LEGAL NOTES.

At the Trial Term in Rochester, N. Y., Justice Nash granted a non-suit in the case of Isaac Hooper against the Rochester Gas & Electric Company. Hooper sued for $2,000 damages for alleged negligence of the company, because while driving along the street an arc light fell on him, injuring his head.

At Watertown, N. Y., on the 20th ult., a verdict for plaintiff was rendered in the suit of Charles Cohen against the Thomson-Houston Company. The action was brought to recover $150,000 for services rendered in South Africa and for damages by reason of an alleged wrongful dismissal as agent of the company. The Watertown *Times* in its comments on the case furnishes the following particulars:

"The real defendant in the action is the General Electric Company, for that corporation is to all intents and purposes the successor of the Thomson-Houston Company. The evidence from which the jury rendered its verdict was almost entirely letters that passed between the parties. Mr. Cohen was in South Africa, working in the interest of the defendant, for nearly four years. There he was confronted with a conservatism which demanded a great deal of missionary work. The letters gave the jury a very clear idea of the magnitude of this work and the almost insurmountable obstacles which had to be overcome. His claim is that when this conservatism was in a measure removed, when it seemed very probable that Mr. Cohen would soon realize something from his incessant labor, he was told that there was no contract between him and the company, and that the implied contract was at an end. It was claimed on behalf of Mr. Cohen that the reason of this was that the Thomson Houston Company had been merged into the General Electric Company, which found that it could get the business with less expense by some other method than through Mr. Cohen. He had exploited the goods at the expense of a great deal of money and over three years of hard labor.

"The company claimed that it had the lawful right to sever its connection with Mr. Cohen, inasmuch as, after three years, he had not succeeded in getting any business for them.

"An appeal will probably be taken in the case, but it is the opinion of many lawyers, who have watched the case, that it will not succeed. Justice Hiscock was very careful in the trial of the case to hold the attorneys back from presenting incompetent evidence, and his charge was a model of its kind. He examined carefully the law that was presented to him by the attorneys, and every point was closely analyzed without prejudice to either side. The only ruling on which it seems an appeal can be taken is his refusal to hold as a point of law that the discharge from employment of the plaintiff by the defendant was a lawful one. He held that it was a question to go to the jury under instructions by the court.

"The next step to be taken is the appointment of a referee to assess damages, and the attorney who is selected will have steady employment for some time."

CANADIAN NOTES.

The Cataract Power Company of Hamilton, Ont., have connected their transformers with the city wires of the Hamilton Electric Light & Power Company, and the incandescent lights will be supplied with electricity developed at Decew's Falls, which are about 34 miles distant from the city.

An important question is to come up at the next meeting of the Hull Electric Company of the city of Hull, opposite Ottawa, in Quebec province. A project is on foot to alter the cars now in use so that they can be run at 40 miles an hour. By doing this less cars will, it is calculated, be required, and therefore fewer men will be employed.

Mr. W. C. McDonald, the millionaire tobacco manufacturer of Montreal and the generous benefactor of McGill University of that city, has again demonstrated the interest he takes in that institution of learning by presenting to the department of electrical engineering the sum of $30,000 with which to purchase the best and most modern electrical apparatus. This gift will enable the department to acquire much-needed apparatus, and it is said that when all is in place the department will take first rank among the many departments of electrical engineering on this continent.

It is confidently predicted that the valley of the St. Maurice river, which is now a densely-wooded wilderness, will in ten years be a hive of industry. Three immense enterprises are already at work—the Shawinigan Power Company, Lawrentide Pulp Company and the Canada Iron Furnace Company. The first-named company is preparing to develop electric power in enormous quantities, available for industries which will follow and for transmission to Montreal, Quebec and other manufacturing centers. The natural lay of the land and water is such that power can be developed at a minimum of cost. The company is proceeding to install a plant which will be able to develop 30,000 horse power, to be eventually increased to over 100,000 horse power. The engineers estimate that 200,000 HP. can be developed.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILWAYS.

Birmingham, Ala.—The North Birmingham Electric Railroad, running from Birmingham to North Birmingham Park, a distance of four miles, has been in operation for several days, the street dummy that formerly plied between these two points having been abandoned. The Birmingham Traction Company, which acquired the seven-mile Gate City dummy line and converted that into a modern electric road, is also the owner of the North Birmingham line.

Bluffton, Ind.—A new electric railway project is in the air here which involves a direct line from Fort Wayne to Indianapolis. The new road will start from Alexandria, run to Gaston, in Delaware county, and thence to Hartford City. From Hartford City the line will run parallel with the Lake Erie & Western road to Fort Wayne, the northern terminus, taking in Montpelier and Bluffton.

Brooklyn, N. Y.—The Flushing and South Shore Line of the Long Island Railroad, which is to run from Flushing to Jamaica and to Far Rockaway, Rockaway Beach and other beaches, is to be equipped with electricity, and the road it is expected will be running next summer. Work on the line is already under way. It is proposed also to extend the Huntington electric railroad to Huntington Bay and Cold Spring Harbor.

Elwood, Ind.—Charles L. Henry of Anderson; Thomas Day of Indianapolis, and T. C. Burkley of Hartford City, met here a few days ago with others interested in the electric line from Elwood to Indianapolis via Perkinsville and Noblesville, and it was decided to build the road. The farmers along the route are anxious for it and have offered substantial assistance.

Gloucester, Mass.—The Gloucester "Breeze" of October 24 says: "A. R. Hallowell, ex-superintendent of the Gloucester Street Railway, and Samuel L. Gibson of this city sailed from New York Saturday for Ponce, Porto Rico. It is said that Mr. Hallowell goes there as the representative of a New York electrical syndicate with the hope of securing franchises for an electrical street railway. The syndicate he represents has ample capital and will construct a road equal to the best in this country. It is reported that President Fer-

guson of the local street railway company is much interested in the enterprise."

Chicago.—The Illinois Traction Company, a new corporation, proposes to operate an electric street car line between Grand Crossing and South Chicago. It is said to be backed by a number of capitalists who are abundantly able to equip and operate the line. John M. McCabe is acting as agent of the company.

Eau Claire, Wis.—One of the most complete systems of street railway that can be found in the West is that owned and operated by the Chippewa Valley Electric Railway Company, which controls about twenty miles of track, operating its handsomely appointed cars in the cities of Eau Claire and Chippewa Falls and connecting the two cities, 12 miles apart, by an interurban line. The power is furnished from Eau Claire and is sufficient to propel cars thirty miles an hour. C. E. Kelsey of Eau Claire is president of the company.

Honolulu, Hawaii.—A traction company has been organized in this city to be known as the Honolulu Rapid Transit & Land Company. Its officers are: President, L. A. Thurston; vice-president, J. B. Castle; secretary, J. A. Gilman; general manager, C. G. Bellentyne. The general manager is expected to arrive in New York about December 15 to make purchases for the road, which is to be operated by electricity, but by what system is not yet definitely known.

Joplin, Mo.—The Southwest Missouri Electric Railway, perhaps the longest continuous electric line in the world, has been reorganized and the controlling interest has passed into the hands of Joplin and Harrisburg, Pa., capitalists. A. H. Rogers, of Joplin, the promoter of the road, was elected president and treasurer; E. Z. Wallower, of Harrisburg, vice president; A. G. Knisely of Harrisburg, secretary; George J. Paul, of Aurora, Ill., superintendent. The Southwest Missouri line extends from Galena, Kan., through Central City, Joplin, Webb City, Carterville and Prosperity, Mo., to Carthage, Mo., a distance of twenty-seven miles, passing through the heart of the great lead and zinc mining belt.

Montgomery, Ala.—The "Advertiser" states that an electric railroad is to be built from this city to Wetumka. The road will pass Pickett Springs, and part of the plan is to make an attractive artificial lake there and summer resort. In fact the expectation is to develop the line as a resort route. Among the local people mentioned as being interested in the scheme are McD. Cain and W. C. Bibb.

New Hartford, N. Y.—The application of the Sauquoit Valley Electric Street Railroad Company for permission to build and operate a street car line through this village has been granted.

Newport News, Va.—It is announced that a Baltimore syndicate has purchased the bonds of the Newport News and Old Point Railway & Electric Company to the extent of $800,000, and also $400,000 of the cumulative stock of the company, and the understanding here is that important extensions are contemplated, but in what direction is left to conjecture.

Rome, N. Y.—Philadelphia capitalists are said to be negotiating for the purchase of the street railroad here, with the intention of changing its motive power to electricity and extending the system to Sylvan Beach by way of the Rome custodial asylum, Verona, Oneida and Durhamville, the extension to be equipped for freight as well as passengers.

Tonawanda, N. Y.—The Buffalo & Lockport Electric Railway and the Buffalo, Kenmore & Tonawanda Railway will be connected by means of a switch track to be laid along Delaware street, the trustees having granted a franchise permitting the Buffalo & Lockport company to build the switch.

Toronto, Can.—It is stated that H. A. Everett of Cleveland, O., is interested in a scheme by which Buffalo and Toronto would be connected by trolley roads. Mr. Everett is a large owner of shares in existing roads that would be included in the system, and it only requires the building of about 15 miles of new road to complete the chain.

Vicksburg, Miss.—The Vicksburg Electric Car Company are reported to have signed a contract at Chicago with builders for the construction of six miles of street railway in this city. Percival Steele of Chicago owns the franchise. The whole cost of the line will be about $150,000.

LIGHTING.

Boston, Mass.—On the 22d ult., Colonel S. M. Mansfield, chief of the U. S. Engineer Corps for this district, opened bids for the furnishing and erecting of electric lighting plants in the power houses of the new gun batteries at Grovers Cliff, Winthrop and Nantasket Head. The bids were as follows: Grovers Cliff—Electric Storage Battery Company, $1,468; General Electric Company, $3 295; G. M. Angier & Co., $2,385; Bibber, White & Co., $3,659; Almon, Sargent & Conant, $3,925; New Jersey Foundry & Machine Company, $3,549; Lord Electric Company, $2,972. Nantasket Head—G. M. Angier & Co., $2,610; Almon, Sargent & Conant, $4,175; Bibber, White & Co., $3,434; New Jersey Foundry & Machine Company, $3,772; Lord Electric Company, $3,092; General Electric Company, $3,650; Electric Storage Battery Company, $1,468.

Colville, Wash.—J. R. Cook and Paul Laplante will shortly apply to the town council for a franchise to put in waterworks and an electric light plant in Colville.

Edwardsville, Ill.—The electric light and ice plant of the Edwardsville Electric Light & Power Company was destroyed by fire on the 24th ult. The plant was valued at $40,000 and was insured for $16,000.

Greensboro, N. C.—B. S. Johnson and others, of Baltimore, Md., contemplate installing an incandescent electric lighting plant in Greensboro.

Hartford, Conn.—The Cromwell Water Works Company has bought the Allison Hammer Factory, which has been vacant for several years, for the purpose of establishing a plant for lighting the town of Cromwell by electricity.

Huntingburg, Ind.—This city proposes to have electric lights if a company will put in a plant and rent it to the city with the option of purchasing in ten years. The plant at the outset would be required to furnish about 500 incandescents for commercial purposes and 35 arcs for street lighting.

Independence, Mo.—W. T. Felton of Kansas City, representing a company of Kansas City capitalists, has filed in the city council an application for a 20-year franchise for a new electric light plant to be erected in this city.

Lodi, N. J.—The council has passed to third reading the ordinance granting a franchise to the Lodi Light, Heat & Power Company.

Merrill, Wis.—The plant of the Merrill Lighting & Railway Company was destroyed by fire on the 19th ult. The plant was valued at $10,000 and was insured for $3,000.

Richmond, Va.—The Richmond Paper Manufacturing Company has awarded a contract for installing an electric light plant at their mills in this city to the Electric Construction Company of Virginia. The plant is to be first-class in every particular, with direct coupled multipolar steel Diehl dynamos, and is to conform in every respect to the plant recently erected by the same company for the city of Richmond at the new pump-house.

Sumter, S. C.—The city will receive bids up to December 1 on a 10 or 15 year contract for 37 arc lights of 2,000 CP., and for about 160 incandescent lights. C. M. Hurst, city clerk, will furnish information.

Weedsport, N. Y.—It is reported that J. D. Edwards will have a partner from Syracuse in the business of furnishing Weedsport with incandescent electric lights for private use.

Westwood, N. J.—At a public meeting held here recently to discuss the question of lighting the streets, a vote was taken to ascertain the choice of the people as to the kind of light they preferred for the purpose, resulting as follows: for electricity, 50; gas, 18. Seven votes were cast for no light.

Whitesboro, N. Y.—At the special election on the 24th ult., to decide whether the village should be lighted by electric or Welsbach lights, the vote cast was in favor of electricity 119 to 32.

MANUFACTURING, ETC.

Cleveland, O.—Bids will be received until November 16 at the Cleveland State Hospital for two 50 KW. 110 volt direct connected dynamos to operate at 300 r. p. m.; one 10 HP. motor; one 7½ HP. motor; one 4 HP. motor; one 50 KW. dynamo, wiring, etc.; two automatic high speed engines, each to develop 75 HP. at ¼ cut off and 80 lbs. pressure, etc. General conditions and specifications will be furnished by the engineers, E. P. Roberts & Co., Osborn building, Cleveland.

Houston, Tex.—A company has been organized here to erect a handsome building for the purpose of exhibiting all kinds of manufactured products and novelties. It is estimated that at least 30,000 persons will visit the exhibition every month.

Newark, N. J.—Gould & Eberhardt are just shipping eight of their improved drills to the U. S. Government at Rock Island, Ill., and some for Brooklyn, N. Y. Also have a number of other Government orders for their patent extension base shapers for the various arsenals, as well as some automatic gear cutting machines. The works have been very busy for some time back working on orders for their improved tools.

North Adams, Mass.—A plan has been hit upon to keep the Hoosac tunnel clear of smoke. The plan is to build a hood over the central shaft of the tunnel and erect a mammoth centrifugal fan under the hood and draw up the smoke by suction through the operation of the fan. The fan will be so large that it will require a 25 horse power electric motor to run it and this is to be furnished by the Stanley Electric Company. The North Adams Electric Company will supply the current.

Richmond, Va.—The American Tobacco Company has installed a 120 KW. generator and sixteen electric motors in its factories in this city, to take the place of steam apparatus heretofore in use. The new machinery was furnished by the Westinghouse Company. Electric plants are being also installed at the factory and mills of the Virginia & North Carolina Wheel Company and at the works of the Richmond Guano Company.

Suffolk, Va.—David Reckard has established works here for the manufacture of dynamos and other electrical appliances.

Washington, D. C.—U. S. Consul J. C. Monahan at Chemnitz has furnished the State Department with an important report on "Opportunities for American Trade in Germany." He says: "Excellent opportunties are being offered here for the importation of American tools, electric appliances, and all kinds of articles used in the construction and equipment of railroads, etc. Everywhere from one end of the Empire to the other lines are being opened, extended or improved. It seems to me we might sell millions of marks worth of the wooden parts for cars as well as rails, wires, apparatus, etc. If we 'worked' this empire and the whole Continent as carefully as Germans 'work' the United States, from Portland Me., to Portland, Ore., our exports of tools and machinery here would swell within a few years to double their present proportions. Only a few of the 'bench men' know how much better are many of our tools and machines than those made in Germany."

TRANSMISSION PLANTS.

Denver, Col.—The Denver "Post" of the 18th ult. says: "The many schemes for harnessing the Platte and making it do Denver's drudgery work have come to a head and the Denver Power & Irrigation Company, a million dollar enterprise to furnish electric light and power to Denver, is fairly launched. The company plans to dam the South Platte river; to pipe the water thus dammed to Deansbury and then by the use of turbine wheels to generate power sufficient to furnish electricity to the street car lines of the city, to the Consolidated Electric Company, to all small manufacturers and to the proposed Denver & Cripple Creek Short Line Railroad. James E. and Walter Rhodes of Denver are among those behind the enterprise. They have carried out successfully power transmission enterprises of a similar character at Ogden, Utah, and Anaconda, Mont. The bonds of the company have recently been taken in the East as a result of the close of the war and renewed confidence in Western investments."

Kalamazoo, Mich.—The Kalamazoo Electric Company has a big scheme in view. It proposes to light nearly every town in Southwestern Michigan and furnish power enough for the operation of all the trolley cars in Kalamazoo and Allegan counties. The plan is to dam the Kalamazoo river near Allegan, and with the water power obtained generate electricity enough to light Plainwell, Otsego, Allegan, Battle Creek and other towns and the country between them and run trolley cars besides.

Leadville, Col.—Dr. M. J. Ricoff of London is in this city to arrange for the construction of an electric power plant at Malta, the power of which is to be utilized by mining men. Dr. Ricoff says the plant will be built if mining men guarantee their patronage. The doctor goes from here to Salt Lake to investigate mining property, and then goes to New York, there to report to his company.

Tacoma, Wash.—William T. Baker, president of the Snoqualmie Falls Power Company, has addressed a long letter to the mayor and council in which he presents his objections to several provisions of the franchise offered him by the council to supply electric service in this city. The council has refused to modify the franchise to meet Mr. Baker's views and are now considering the scheme of Mr. Talbot for a municipal plant, the power to operate which would be generated at the Puyallup falls.

COMPANY MATTERS.

Des Moines, Ia.—Amended articles of incorporation of the Des Moines Edison Light Company were filed with the county recorder in this city on the 19th ult. The principal change is in the amount of the capital stock which is increased from $136,000 to $450,000. The "Leader" says "the purpose is to further the consolidation of the electric lighting business in Des Moines. Besides the Capital City plant, operated by the gas company in conjunction with its business, there are two other plants in Des Moines which up to the present time have been conducted by two corporations, though in reality they have both been owned by the General Electric Company for the past eighteen months. They are the Fort Wayne and the Des Moines Edison. In the foreclosure proceedings against the Fort Wayne plant the General Electric Company, which owns all the stock of the Des Moines Edison, bought up the bonds and bid the property in for them. It is the purpose now to exchange these bonds for the stock of the Des Moines Edison Company and thus complete the consolidation of the two plants."

Madison, Wis.—The People's Electric Company, dealing in electrical supplies, has made an assignment. Liabilities, $8,500, and assets about the same.

New Brunswick, N. J.—The Brunswick Traction Company, which controls all the trolley lines in Middlesex county, N. J., and also lines in Somerset and Union counties, has been merged with the New York & Philadelphia Traction Company. Judge Gottfried Krueger of Newark, Andrew Radel of Bridgeport, and E. H. Radel of New Brunswick have purchased a controlling interest in the New York & Philadelphia Company. J. Blair MacAfee, vice-president of the New York & Philadelphia Company, will retain his office, and his company will be operated under the direction of the Brunswick Company.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—The elevators in the Capitol will hereafter be operated altogether by electricity. The old mechanism was very primitive and many unfavorable comments were made on the subject by those who had most occasion to use the elevators. But now every

thing has been arranged in the most modern manner and there will be no occasion for complaint.

Chatham, N. Y.—The Chatham Electric Light, Heat & Power Company, which has recently constructed an electric light plant on the Kinderhook creek to operate the lights in Chatham, will also erect a mammoth grain elevator with a capacity of 100,000 bushels. All the machinery will be operated by electricity. The improvements are to be on an elaborate scale, making this the most extensive plant of its kind in Columbia County.

Troy, N. Y.—The Troy City Railway has effected a settlement with the heirs of a number of persons who were killed in the crossing accident at Cohoes on Labor day. The heirs of the three sisters who were killed received $3,000 in each case. A man whose wife and two daughters were killed in the collision received $10,000 as the representative of their estates. It is believed that the railway company will effect a settlement with those who were injured at the time of the accident, thus avoiding much litigation and possibly heavy adverse verdicts.

Oswego, N. Y.—The receiver of the Oswego Street Railway Company and the Lake Ontario and Riverside Railway Company advertises that all claims must be presented on or after the 14th day of November, 1898.

PERSONAL AND MISCELLANEA.

G. Mortimer Williams, general manager of the Birmingham (Ala.) Traction Company, has resigned, and been succeeded by George H. Clarke, superintendent of the company.

Clarence G. Davenport, formerly expert and agent of the General Electric Company at 44 Broad street, New York, who went to Porto Rico with the 1st Regiment Volunteer Engineers, died of typhoid fever at Ponce on October 26. He was an associate member of the American Institute of Electrical Engineers, having been elected November 21, 1894.

A press dispatch from Hudson, Mich., states that James Whitcomb of that town has invented an electric light which promises to displace the regular lights. It is fed by a current from a chemical, the light being similar to the regular incandescent light. Mr. Whitcomb has made arrangements with the Gilliland Electric Company of Adrian for the manufacture of the apparatus. It is stated in the same dispatch that experts in electricity pronounce the new light a success.

One hundred and fifty members of the electrical trades from New York, Boston, Philadelphia and Connecticut, accompanied by ladies, witnessed the performance of "The Fortune Teller" at Wallack's Theater, New York, on Tuesday night last week. The party, several of the men being bald-headed, occupied the first rows of the orchestra, and gave a hearty reception to Miss Nielsen and other members of the company. At the conclusion of the second act a bouquet of roses in which were placed six electric lights of three-candle power each, fed by dry batteries, was presented to Miss Nielsen. After the performance the entire party entered automobiles and were taken to the Waldorf-Astoria, where supper was served.

The Kansas City "Star" says it has discovered why the Metropolitan Street Railway Company stops running its cars after midnight. It says: "The explanation of the mystery is that the Metropolitan Company has felt that the midnight stoppage of cheap transportation has stimulated a disposition on the part of the Kansas City people to go home early in the evening. If owl cars were the rule young and thoughtless husbands and those who are old and cunning would find manifold and plausible excuses to remain down town until past the hour of midnight. When it comes to paying fifty cents and $1 for a carriage, even the most frivolous minded revelers have found reason to hustle around and catch the last car. Thus, all unknown to an ungrateful community, the Metropolitan Street Railway has established and maintained the sobriety and thrift of the male population of this town and saved many a a lone woman from sitting up, wearily waiting for her wandering boy or tardy husband. All honor to the thoughtfulness and philanthropy of the Metropolitan Street Railway, the good angel of Kansas City!"

A Denver electrician speaking of the numerous processes for the reduction of ores now being exploited in that city and basing their claims to recognition upon electricity, says that "electricity will only aid in the precipitation of gold that has already been discolved, and that no method had yet been discovered by which the values can be extracted directly from the ore by its use. Chemicals must first be used to extract the gold, electricity may then aid in collecting it."

Secretary Alger, when at Montauk, paid a high tribute to the members of the Second Regiment Volunteer Engineers. "This organization," said he "has always been found ready to perform any duty required of it. It has been given some very important work, and has never failed to do it in the best possible manner. There have been no complaints from its members, either about sickness or lack of food, and we have not been bombarded by showers of requests for discharges of the men. They have behaved like true soldiers, and I wish that we could always keep them in the service. They are genuine patriots, for most of the members of this regiment sacrificed good salaries to serve in the army. Some of the most eminent civil engineers, draughtsmen and electrical experts in the country are to be found in the regiment—men who were receiving salaries ranging anywhere from $5 to $30 a day before they entered the volunteer service."

RECENT COMPANY ELECTIONS.

Jamestown Street Railway Company, Jamestown, N. Y.—President, A. N. Broadhead; vice-president, L. B. Warner; secretary and treasurer, S. B. Broadhead; superintendent, G. E. Maltby; directors: A. N. Broadhead, S. B. Broadhead, William Broadhead, W. S. Cameron, L. B. Warner, F. E. Gifford, R. N. Marvin and O. E. Jones.

Lowell Lawrence & Haverhill Street Railway Company, Lowell, Mass.—President, G. H. Campbell; vice-president, Alfred A. Glasier; treasurer, G. E. Tripp; directors: Alexander B. Bruce, G. H. Campbell, William Endicott, 3d, Temple R. Fay, Alfred A. Glasier, Francis R. Hart, Arthur R. Robertson, Edwin S. Webster and Harry K. White.

Rockland & Abington Street Railway Company, North Abington, Mass.—President, A. L. Register; clerk, George W. Kelley; treasurer, Charles N. Cobb; directors: David Pepper and Albert L. Register of Philadelphia, Pa., George W. Kelley and John Spence of Rockland, Charles N. Cobb of Abington, A. H. Brooks of Boston, and G. F. Wells.

Tri-City Railway Company, Davenport, Ia.—President, E. E. Cook, Davenport; vice-president, F. C. Denkman, Rock Island, Ill.; secretary and treasurer, J. F. Lardner, Davenport; directors: the officers and W. H. Edwards of Rock Island and H. A. Ainsworth of Moline.

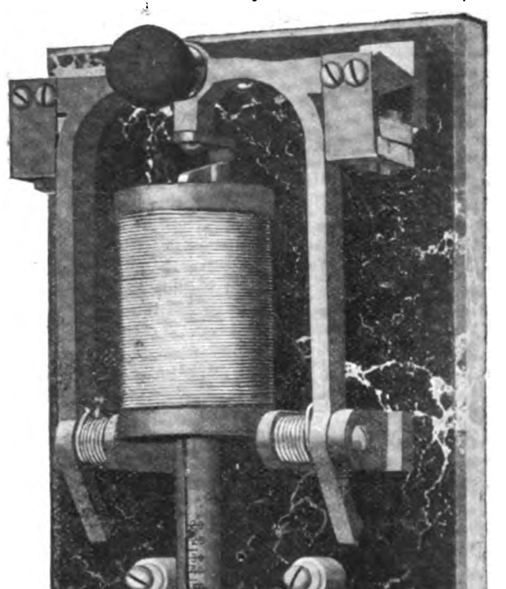
West Roxbury & Roslindale Street Railway Company, West Roxbury, Mass.—President, T. T. Robinson; treasurer, F. N. Terrell; directors: Robert Bleakie, J. S. Bleakie, Clifford Devens, R. B. Fairbairn and N. P. Whittemore.

COMMERCIAL PARAGRAPHS.

A New Circuit Breaker.

The cut presented herewith illustrates a new type of single pole circuit breaker manufactured by the well known firm of F. A. La Roche & Co., 13th and Hudson streets, New York City.

This circuit breaker is also made with over and under load attachments for motor work. It is especially adapted for high voltages ranging in the neighborhood of 2,000 volts, and is guaranteed to break 2,000 volts successfully without arcing at the clips. This feature is accomplished by the method in which the carbons are attached to the breaker. It will be noticed that the carbons are parallel to the clips, and as the breaker opens, the carbons attached to the blades open with a cam motion which keeps a rubbing contact on the stationary carbon until the blades themselves are well out of the clips and at a safe distance, then



the circuit is finally broken through the carbons and below the clips, so that no burning of the clips or blades can possibly take place. The blades are of the wedge type and close into "V" shape clips. These are laminated and flexible to an extent, so that they adapt themselves to the shape of the blades, and an absolutely tight contact is thereby formed.

The latch and trigger are made of case hardened steel and are of the compound lever type, so constructed as to permit of a very weak solenoid being used, as the force of the blow required to operate the breaker is very small. This method of construction is new in this style of instrument.

The hinge posts and blade arms do not carry any current, and it will be noticed by referring to the cut that there are two phosphor bronze springs in each hinge. These springs are quite weak and only strong enough to give the switch a sharp and quick break. Owing to the peculiarly shaped blades and clips, it is an absolute impossibility for the circuit breaker to stick, and the construction of the clips tends to throw the blades out of their own account. This breaker would really operate without these springs in the hinge, the springs being there only to assist in quickening the motion. On the bottom of the lever arms are two projections which are parts of the blade frame and come in contact with a buffer, so that when the breaker is opened and performing its function the blow on the hinge post is reduced to a minimum. Underneath the solenoid is a copper tube upon which is marked the calibration in amperes and fractions thereof. Upon the end of this tube is a milled head screw and nut, which admits of adjusting the circuit breaker to open at any desired point within its guaranteed high and low ampere ratings.

These circuit breakers are handsomely finished in copper throughout, no brass or iron being used. They are undoubtedly the neatest and most substantial circuit breakers on the market for motor work; they cannot fail in their operation and will perform their duty satisfactorily under the most trying circumstances. They are mounted on either white marble or marbleized slate bases as may be desired, and require no remounting, as each breaker is provided with binding posts, and will operate in a box or panel board requiring only 5 inches depth; it is simply necessary to run a wire to said binding post without any other connections or mounting.

Special care is taken to calibrate these instruments, and they are as reliable as any standard amperemeter; they are made in sizes from 15 amperes up to 500 amperes, above that the manufacturer recommends the "Victor" No. 1 circuit breaker or the "Ideal" circuit breaker, both of which are manufactured by the firm of F. A. LaRoche & Co., 13th and Hudson streets, New York City.

The Electric Appliance Company, Chicago, are meeting with great success in the sale of their combination fuse block and lightning arrester for telephone work. It seems to fill a large demand for an efficient device for protecting telephone apparatus, and the Electric Appliance Company have yet to hear of a single case where it has failed to operate in an entirely satisfactory manner.

INCORPORATIONS.

The Council Bluffs Gas & Electric Company, Council Bluffs, Ia. Capital stock, $250,000.

The Wisconsin Storage, Electric & Water Company, Plymouth, Wis. Capital stock, $25,000.

The Electric Therapeutic Manufacturing Company, Indianapolis, Ind. Capital stock, $5,000.

The Electric Heat & Power Company, Chicago. Capital stock, $5,000. Incorporators: Charles B. Coffeer, Alvah S. Hopkins and Howard B. Cook.

The Warsaw Electric Company, Warsaw, Ind. Capital stock, $30,000. Incorporators: Noah J. Clodfelter, A. T. Spencer, Charles J. Lohman and J. C. Hamilton.

The Sutton-Steele Electrical Company, Dallas, Tex. Capital stock, $20,000. Incorporators: Walter L. Steele, Henry M. Sutton, Emmett A. Ellis and J. L. Sale.

The Bonham Electric Light & Power Company, Bonham, Tex. Capital stock, $25,000. Incorporators: J. F. Arledge, J. B. Russell, J. N. Rainey and E. F. White.

The Cass & Aaron Company, Chicago—to manufacture electrical machinery and supplies. Capital stock, $10,000. Incorporators: Rush S. Palsbury, Jacob Aaron and Philip Cass.

The Diamond Meter Company, Peoria, Ill.—to manufacture electric meters and other appliances. Capital stock, $30,000. Incorporators: E. H. Couch, W. E. Heyle, A. B. Fink and O. A. Scheefer.

The Higgins-Olmstead Company, Rochester, N. Y.—to manufacture and sell gas and electric fixtures. Capital stock, $10,000. Directors: Ezra M. Higgins, Morris Olmstead and J. Lansing Stewart, all of Rochester.

The Dayton & Xenia Traction Company, Dayton, O—to build and operate an interurban street railway between Dayton and Xenia. Capital stock, $300,000. Incorporators: J. M. Wilson, O. O. Ozias, F. D. Bittinger, Isaac G. Kennedy and Philip A. Kemper.

The Northern Development Company, Bangor, Me.—to produce, lease and sell electricity and other power for manufacturing and other purposes within the Indian townships Nos. 1 and 2 in Penobscot County, etc. Capital stock, $1,000,000; nothing paid in. President, Henry M. Prentiss of Bangor; treasurer, Charles W. Mullen of Oldtown; directors: Henry M. Prentiss and Charles W. Mullen.

Dayton & Eastern Traction Company, Dayton, O.—to operate an interurban electric railway. Capital stock, $10,000. Directors: Henry B. Pruden, George R. Wright, H. O. Cox, William A. Mays and W. S. McConnaughey.

The Perth Amboy Railroad Company, Perth Amboy, N. J. Capital stock, $30,000. Incorporators: Leonard Lewisohn, Adolph Lewisohn and Charles J. Witterberg of New York City; James T. McCoy, George J. Haney, William E. Tobey, O. P. Sells, Wesley J. Havel and Sidney Riddlestorffer of Perth Amboy.

The Tonawanda Cataract Power Company, Tonawanda, N. Y.—to distribute electricity for light, heat and power within the town of Wheatfield and city of North Tonawanda and the town and village of Tonawanda. Capital

stock, $100,000. Directors: Charles A. Sweet and Lincoln A. Grow, of Buffalo; Edward D. Adams, Francis Lynde Stetson, Edward A. Wickes and William B. Rankine, of New York City.

The Dundas Electric Company (Limited), Dundas, Can. —to supply steam, heat, electricity or natural gas for heat, light and power. Capital stock, $40,000. Some of the members of the company are George Hamilton Harper, Richard Todd Wilson, James John Grafton, Emilia Beatrice Harper and John Bertram, all of Dundas.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED OCTOBER 25, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

612,875. Trolley-Stand. William T. Shryock, Allegheny, Pa. Filed July 20, 1897.

612,929. Insulator and Hanger for Electric Railways. Willie C. Keithey, San Francisco, Cal. Filed Jan. 26, 1898.

613,084. Underground Electric Railway. George W. Smith, St. Louis, Mo. Filed May 28, 1898.

613,175. Underground Electric Railway System. Fred D. Robb, Hot Springs, Ark. Filed July 2, 1897.

613,181. Trolley-Pole. John Walsh, Elyria, Ohio. Filed Nov. 2, 1896.

ELECTRIC LIGHTS AND APPLIANCES.

612,999. Electric-Lamp Guard. Herman M. Underwood, Chicago, Ill., assignor to Louis M. Cole, same place. Filed Aug. 19, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

612,943. Electric Furnace. Louis Bresson, Lyous, France. Filed Feb. 8, 1898.

612,977. Armature-Winding. Andrew L. Riker, New York City. Original application filed Nov. 19, 1897. Divided and this application filed April 18, 1898.

613,090. Apparatus for Producing Radiation of Electricity. Charles H. Stearn and Charles F. Topham, London, England; said Topham assignor to said Stearn. Filed Dec. 20, 1897.

613,116. Dynamo-Electric Machine or Motor. Sidney G. Brown, London, England. Filed April 9, 1898.

613,135. Alternating Current Electric Motor. Anthony S. Frazer, Tynemouth, England. Filed Dec. 28, 1897.

613,177. Safety Device for Suspended Conductors. Joseph N. Thomas, Johnstown, Pa., assignor to the Steel Motor Company, same place. Filed Jan. 20, 1898.

613,203. Alternating-Current-Motor System and Method of Operating Same. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Societe Anonyme pour la Transmission de la Force par l'Electricite, same place. Filed April 10, 1897.

613,204. Alternating Current Asynchronous Machine. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Societe Anonyme pour la Transmission de la Force par l'Electricite, same place. Filed May 4, 1897.

613,205. Electric-Current Leveler. Maurice Hutin and Maurice Leblanc, Paris, France. Filed Dec. 16, 1897.

613,206. Method of and Means for Synchronizing. Maurice Hutin and Maurice Leblanc, Paris, France. Filed Dec. 30, 1897.

613,209. Alternating-Current Dynamo-Electric Machine. Maurice Leblanc, Paris, France, assignor to the Societe Anonyme pour la Transmission de la Force par l'Electricite, same place. Filed April 10, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

613,036. Telephone-Exchange System. Charles S. Heilman, Philadelphia, Pa., assignor, by direct and mesne assignments, of three-fourths to James S. Thompson, North Tonawanda, N. Y. Filed Nov. 21, 1896.

613,080. Telegraphy. Clarence D. Royse, Greencastle, and Walter A. Royse, Indianapolis, Ind., assignors to themselves and Mollie M. Royse, Indianapolis, Ind. Filed Aug. 11, 1897.

MISCELLANEOUS.

612,810. Railway Signal. William Andrews, London, England. Filed Dec. 20, 1897.

612,880. Electric Contact-Box. Joseph N. Thomas and William M. Brown, Johnstown, Pa., assignors to the Johnson Company of Ohio. Filed March 22, 1898.

612,885. Annunciator. Oscar Weiderhold, Summit, N. J. Filed Oct. 2, 1897.

613,054. Electric Fan. Daniel L. Bates and Russell H. Bates, Dayton, Ohio. Filed July 21, 1898.

613,062. Thermostat. Wilson E. Facer, Cleveland, Ohio, assignor of one-half to Charles H. Tucker, same place. Filed Nov. 4, 1897.

613,128. Electric Switch. William Ely, Providence, R. I. Filed Sept. 5, 1896.

613,129. Electric Switch. William Ely, Providence, and Walter B. Bernardini, Lakewood, R. I., assignors to the Hone Electric Appliance Company, Providence, R. I. Filed July 29, 1896.

TELEPHONE AND TELEGRAPH.

The Sine-Wave System of Telegraphy.

General Greely, Chief Signal Officer, in his annual report expresses his belief that the discoveries and inventions of Prof. A. C. Crehore and Lieut. Col. George O. Squier, which were fully explained in ELECTRICITY several months ago, have assumed such form and phase as to be of the greatest value to the commercial world. These discoveries outline the sine-wave system and have been tested extensively not only in this country but in England with satisfactory results. An abstract from General Greely's report says the first practical tests of the cable transmitter have just been made through the courtesy of George Clapperton and other officials of the Commercial Cable Company of New York. The experiments were made over the cable between New York City and Canso, which had a length of 827 knots and electrical resistance of 13,000 ohms, and an electric distributing capacity of 231 microfarads. These tests were made between September 25 and October 16, 1898.

The change from existing telegraphic methods consists in the substitution for the present appliance of a transmitter sending smooth waves, such as are obtained in alternating currents, working without making any other changes whatever in the elements of the present system. The conditions for the transmission of messages over long cables are distinctly and widely different from those on aerial lines. The necessity of increased speed over ocean cables, while not generally appreciated, is strikingly obvious when examined from a commercial standpoint. Since every cable spanning the Atlantic Ocean costs several million dollars, the value of any discovery that will increase the working power of these is at once apparent. General Greely has no hesitation in expressing his opinion that the sine-wave system, which also admits of easy duplexing, will within a year or two increase very materially the working capacity of every cable to which it is applied.

Advices from South Africa state that no sooner was the British flag floating over Omdurman than Mr. Cecil Rhodes at once took steps for expediting his scheme for a trans-African line of telegraph from Cape Town to Cairo. Mr. Rhodes's lieutenant, R. D. Mohun, has already left Bombay with an expedition, bound either for Zanzibar or Mombasa. The party will take advantage of the agreement lately come to between the promoters and the Congo Free State and will construct a telegraph line from Lake Tanganyika to Stanley Falls, on the Upper Congo, the work being carried out under the commission of the State. W. Cavendish, the well known explorer, is already carrying the line northward, through the extreme northern territory of the Chartered Company, and it is confidently expected that he will form a connection with the Mohun line within the next two years. By that time the Tanganyika line will have reached Stanley Falls, and Cape Town will be in telegraphic communication with the chief town on the Upper Congo, or, in other words, half the length of the line which is to connect Cape Town with Cairo will be complete. On the other hand, advices from Alexandria are that the line is being pushed southward as fast as possible. Kitchener kept up complete communication between the front and Cairo, and now the news comes that the line is being carried toward Fashoda from Khartoum at the rate of four miles a day.

The N. Y. *Commercial*, which has lately been giving a good deal of attention to telephone matters, intimates that it has knowledge of a proposed consolidation of the independent companies: It says: "There are about two thousand rivals of the Bell Telephone Company, so great has been the opposition to their system of extortion both in this and other cities. The reason that the existence of these rival companies has been unnoticed is that they have had their birth in the determination of opponents of extortion to establish local telephone services at a reasonable rate. They are scattered companies, lacking the alliance that gives a long distance wire. Since the incorporation of the People's Telephone Corporation there are indications that these scattered companies are to be consolidated, and if this result is brought about the elephant will find that he is no longer merely tormented by the attacks of a host of flies that a swish of the tail disperses, but by an enemy as big and powerful as himself. That the elephant is awakening to a knowledge of this danger the *Commercial* is in a position to know."

The Kansas City (Mo.) *Times* notices the arrival in that city of Charles J. Glidden of Lowell, Mass., the president of the Erie Telegraph & Telephone Company. Mr. Glidden is on a tour of inspection of the different telephone properties in the management of which he is interested. He is reported in the *Times* as saying: "The development in the telephone business throughout the country during 1898 will be far in excess of any previous year since the invention was placed upon the market by Prof. Bell. The companies, more particularly those operating in the thriving sections of the country west of New England, will increase their lists of subscribers from 10 to 25 per cent. The long distance telephone lines are reaching out to every important city and town in the country, and before the close of the century the Atlantic coast will exchange greetings with the far Pacific coast points, marvelous as it now seems. These lines now extend to thirty-three States and bring fully three-fourths of the population of the country within talking distance. The country is practically one immense telephone exchange."

A Mankato, Minn., dispatch dated October 20 says: "What is believed to be a telephone war was inaugurated to-day by the Northwestern Company offering free residence service to those having connections at their places of business. The new local company has its lines up and will be ready for business December 1. The Western Electric Company to-day connected with the Northwestern and removed its toll line from the Blue Earth Valley Company's office."

The long-distance telephone line connecting San Francisco with Portland, Ore., has been completed, and the mayors of the two cities have congratulated each other over the wire. Mayor Phelan of San Francisco sent the following message:

"San Francisco is much gratified to have been brought within direct speaking distance of the city of Portland. Such service will tend to draw us closer together and unify the interests of the Pacific Coast."

To this Mayor W. S. Mason of Portland responded:

"May the commercial relations be woven more closely since the means of communication are by this method a great advance over all previous facilities. May the cities of San Francisco and Portland ever occupy the position of leaders in all enterprises that will advance the interests of the Pacific Coast."

Arrangements have been completed for telephone communication between Armour, S. D., and points west and south. A line will be run to Greenwood, thirty miles south, and also to Edgerton and Wheeler, west on the Missouri river. These points in Charles Mix county are off the railroad and have no other communication with the outside world than by the slow stage mail routes.

The Tuscarawas Home Telephone Company, with headquarters at New Philadelphia, O., a new corporation, intends to operate a telephone system between New Philadelphia, Canal Dover, Uhrichsville, Dennison, Canton, Carrollton, Cadiz, Cambridge, Coshocton, Millersburg, Wooster and neighboring villages.

Henry C. Garber, solicitor for the Central Union Telephone Company, was indicted by the grand jury at Akron, O., recently on the charge of promising a bribe to City Commissioner Daniel McGorry. There were four counts in the indictment. Garber's home is at Greenville, O. He claims that the charges against him are false.

At a special stockholders' meeting of the New York & New Jersey Telephone Company, held in Brooklyn on the 27th ult., a unanimous vote was cast favoring the increase in capital stock from $5,000,000 to $8,000,000 proposed by the board of directors. There were 34,493 shares of stock represented out of a total of 46,624.

The city of Paducah, Ky., has sold to the highest bidders two telephone franchises. One was bought by the Kentucky Electric Company for $100, and the American Telephone Company bought the other. The company operating the present system did not bid.

The Duplex Telephone & Construction Company have asked for a franchise to operate a telephone system in Yonkers, N. Y., promising to give a satisfactory service for $3 a month.

The application of John Enoch for a 30 years' franchise to operate a telephone system in Kansas City, Mo., is being considered by the council.

New Companies Incorporated.

The Tuscarawas Home Telephone Company, New Philadelphia, O. Capital stock, $75,000. Directors: James S. Bailey, Jr., Frank W. Bainbridge, John W. Yeagley, O. S. Welty and J. H. Mitchell.

The Kenton Telephone Company, Kenton, O.—to operate a telephone system to Marysville, Bellefontaine, Wapakoneta and Lima. Capital stock, $30,000.

The Fire Alarm Telephone Signal Company, New York City. Capital stock, $100,000; amount paid in, $250. Incorporators: Thomas R. Brown, New York City; L. S. Filbert, John Lamon, Albert Goldstein and F. R. Shattuck, Philadelphia.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Oct 31:						
Albany Ry. Co	100	2,000,000	$1,750,000	1½ % Q., Aug. '98.	151	158
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug, 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Oct 31:						
Allentown & Lehigh Val. Trac. Co.	.	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Oct 31:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Oct 31:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98.	70	70½
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	25½	25¾
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec, 1897.	...	..
Boston, Mass.—Oct 31:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	18¼	13¾
North Shore Traction Co...com.	100	4,000,000	4,000,000		10	13
North Shore Traction Co...pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	76	79
b West End Street Ry. Co...com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	88	..
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	109½	...
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	69¾	70
Brooklyn N. Y.—Oct 31:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	235	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	66¼	66⅜
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR...guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	224	227
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	230	..
Kings County Elevated	....	4,750,000	4,750,000	....	5	5¾
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad...pfd.	......	6,000,000	6,000,000	....	70	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Oct 31:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	65	66
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	78½	79½
Columbus O.—Oct 31:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Aug., '98.	54½	55½
Columbus Central Street Railroad	100	1,500,000	1,500,000		..	..
Charleston, S. C.—Oct 31:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '98.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Oct 31:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q.	290	295
Chicago & South Side R. T. RR	100	10,823,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	12	12½
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Oct., 98.	223¼	224
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Oct. 98.	95¾	96¼
jChicago West Div. Ry...guar.	...	1,250,000	624,900	35 %		
kChicago Passenger Ry...guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Oct 31:						
Cincinnati Inc. Plane Ry...com.	50	1,000,000	575,000		..	20
Cincinnati Inc. Plane Ry...pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000		23	25
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	117	117¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Oct 31:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	39	41
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	70½	71
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98.	79¾	81
Detroit, Mich.—Oct 31:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	...	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Oct 31:						
City Railway Co...com.	100	1,500,000	1,470,600	1½ % Q., Jan.1,'98.	105	..
City Railway Co...pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	103

*Unlisted. † Ex div.
a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Walbrook, Gwynn Oak & Powhatan Railway and Park.
b Leased to Boston Elevated Railroad Company.
c Owned by Brooklyn Rapid Transit Company.
d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.
e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR
g Owned by Atlantic Ave. RR. and leased to Nassau system.
h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.
i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.
k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming the bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Oct 31:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	–
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	–
Holyoke Mass.—Oct 31:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	180	200
Hoboken, N. J.—Oct 31:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	70	–
Indianapolis, Ind—Oct 31:						
**Citizens' Passenger Ry	....	5,000,000	5,000,000	....	24	25½
Lancaster, Pa.—Oct 31:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	–
Lancaster & Col. Electric Ry	....	....	87,500	....	..	–
West End Street Railway	....	....	....	....	..	–
Louisville, Ky.—Oct 31:						
Louisville Ry...com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	35	40
Louisville Ry...pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	101	103
Minneapolis, Minn.—Oct 31:						
Twin City Rapid Transit...com.	100	17,000,000	15,010,000	....	27	30
Twin City Rapid Transit...7 % pfd.	....	8,000,000	1,714,200	1¾ %. Jan., '98.	99	101½
Montreal, Canada.—Oct 31:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	278	27[illegible]¼
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	103½	108⅞
Memphis, Tenn.—Oct 31:						
Memphis Street Railway Co	100	500,000	500,000	....	15	–
New Haven, Conn.—Oct 31:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	–
Winchester Avenue RR	25	1,000,000	600,000	....	40	42
New Orleans, La.—Oct 31:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	150	..
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	121½	125
New Orleans Traction Co...com.	100	5,000,000	5,000,000	....	1½	8½
New Orleans Traction Co...pfd.	100	2,500,000	2,500,000	....	8	11
aCrescent City RR...guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	13½	32
bNew Or. City & Lake RR...guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	83	85
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23	25½
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	52½	55
New York—Oct 31:						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	..
cChristopher & 10th Sts. RR...guar.	100	650,000	650,000	2 % Q., July, '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98.	170	190
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98	160½	161½
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	36½	37
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	216½	225
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	180	183
hEighth Avenue RR	100	1,000,000	1,000,000	....	348	355
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	370
jNinth Avenue RR...guar.	100	800,000	800,000	....	180	190
kSixth Avenue RR...guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co...guar.	100	600,000	600,000	4½ % Q.	38[illegible]	420
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	178	180
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. 98.	166	167
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	68	75
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	190
Newark N. J.—Oct 31:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	50	51
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¼ % A.	195	205
Pittsburg, Pa.—Oct 31:						
Allegheny Traction Co	50	500,000	500,000	....	...	..
oConsolidated Traction Co...com.	50	15,000,000	15,000,000	2 %, Jan., '95.	20½	20¾
Consolidated Traction Co...pfd.	50	15,000,000	15,000,000	3 %, May, '97.	56½	..
pCentral Traction Co	50	1,500,000	‖900,000	....	...	...
qCitizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	64½	...
rDuquesne Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	..	...
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	24	..
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	‖2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	25	..
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.
a Leased to New Orleans Traction Company at 6 % on stock.
b Leased to New Orleans Traction Company at 8 % on stock.
c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.
d Operating the former Met. Trac. system, that corporation having become extinct.
e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.
i Leased to Metropolitan Street Railway for 18 % on stock.
j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
k Leased to Metropolitan Street Railway for $145,000 per annum.
l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
m Controlled by Third Avenue Railroad by purchase.
n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.
o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co
p Leased to Consolidated Traction Company for 8 % per annum on par value of stock
q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.
r Leased to Consolidated Traction Company for 6 % on capital stock after October,
s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Oct. 31;						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass—Oct 31:						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Oct 31:						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Oct. 31:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Oct 31:						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	68	70
Philadelphia.—Oct 31:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvi'e, Man. & Fairm't..6 % pfd.	50	533,900	‖533,900	3 % S—July, '98.	67	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	65½	66
Union Traction Co......... $12½ pd	50	30,000,000	29,930,450		19½	19⅞
cElectric Traction Co	50	....	8,297,920		71½	71½
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	3 7	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	394	..
fLehigh Avenue Ry. Co	50	1,000,000	....		47	..
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	265	..
ePeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135	136
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	136	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000		...	..
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402		...	..
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p sh., Oct. 98.	9¾	..
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry......guar.	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	170	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	285	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	2.5	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	230
Rochester, N. Y.—Oct 31:						
Rochester Railway Co	100	5,000,000	5,000,000	....	14	19
Reading, Pa.—Oct 31:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Oct 31:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct., '98.	131	133
National Railway Co	..	2,500,000	2,479,000	1¼ %, Oct., '98.	..	----
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000		..	..
Citizens' RR	100	2,000,000	1,500,000	1 %, Oct., '93.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % Oct., '98.	170	175
People's RR. Co	50	1,000,000	800,000	50c., Dec., '89.	..	..
Southern Electric Ry..........com.	50	500,000	500,000		57½	59½
Southern Electric Ry.......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	114	116
St. Louis & Suburban Ry	100	2,500,000	2,500,000		52	53
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '96.	..	175
San Francisco, Cal.—Oct.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	108	109
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	54⅞	55
Presidio & Ferries RR	100	1,000,000	550,000	....	9	..
Scranton, Pa—Oct 31:						
Scranton Railway Co	50	6,000,000	2,500,000		11	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000		15	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000		..	..
Springfield Ill.—Oct 31:						
Springfield Consolidated Ry	100	750,000	750,000	....	----	11
Springfield O.—Oct 31:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	2
Springfield, Mass.—Oct 31:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	195	205
Toronto Canada.—Oct 31:						
Toronto Ry. Co	..	6,000,000	6,000,000	1¾ % S.	103½	103⅞
Montreal Street Railway Co	..	4,000,000	4,000,000	4 % S.	2.8	278¼
Washington, D. C.—Oct 31:						
Belt Ry. Co	50	500,000	500,000		..	..
Capital Traction Co	100	$12,000,000	12,000,000	65c. per sh, Oct. 97.	78¾	79
Columbia Ry. Co	50	400,000	400,000	6 % A.	75	...
Eckington & Soldiers' Home Ry	50	707,000	652,000		5	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	125	126
Worcester, Mass.—Oct 31:						
*Worcester Traction Co........com.	100	8,000,000	8,000,000	....	11	18
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	9½	98
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Oct 31:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

ij Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1869-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Oct 31:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., Oct., '98.	278	280
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '98.	75	..
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	136	..
New York.—Oct 31:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	97	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q	108	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	179	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	45
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	75	..
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	109	112
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	110	112
Mexican Telephone Co	100	2,000,000	......		..	80
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	1½ % Q., July, '98.	154	155
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	73	78
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	85	90
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., July, '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	92½	93
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Oct 31:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	171	178
Chesapeake & Potomac Telep. Co	100	......	......	....	50	...
Chicago Telephone Co	100	......	......	.....	242	..
Central Dist Prtg & Telg.Co.(Pgh.)	100	750,000	750,000	....	132	134½
Empire & Bay States Telegraph Co.	...	......	......	....	74	76
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	75	76
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	110	118
Providence (R. I.) Teleph. Co	50	....	......	....	87	90
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Oct 31:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1893.	..	..
General Electric Co. [new] ...... "	100	18,276,000	18,276,000	......	82½	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2½	3
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	34	34½
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	57	58
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Oct 31:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,938,000	....	135	189
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '98.	..	..
Edison Ore Milling Co	100	....	......	....	11	14
Edison Electric Storage Co	..	....	......	....	23	30
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug, 1893.	..	...
General Electric Co. [new].... "	100	18,276,000	18,276,000	......	81¾	82
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.—Oct 31:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	130	140
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Oct 31:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	40⅞	41
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	48	48½
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co	10	6,500,000	550,000	$82500 dis. Jan.11'97	13¾	14
Southern Elec. Light & Power Co	10	187,500	187,500	....	16	..
Miscellaneous.—Oct 31:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	82	85
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	14
Eddy Electric Mfg. Co	25	......	......	....	----	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	120	125
Hartford (Conn.) Lt. & Power Co	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	170	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	84	87
Rhode Island Elec. Protec. Co	100	......	......	....	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q ‡	157¼	157¾
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	135	135¼
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	100	..

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200. of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Oct 31:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	85	87
New York.—Oct 31:						
Consolidated Electric Storage Co	...	......	....	....	18	20
Edison European	..	......	....	....	1	3
Safety Car Heating & Lighting Co	100	......	....	......	100	105
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	34	40
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	96	99
Philadelphia, Pa.—Oct 31:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	74½	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	..	15
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	61	...
Welsbach Light Co	5	525,100	......	....	45	46
Welsbach Light Co., Canada	5	500,000	......	....	..	2½
Pittsburg, Pa.—Oct 31:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	117	119
Miscellaneous.—Oct 31:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	...	15
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	...	55
Billings & Spencer Co	25	......	....	....	80	85
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	82	85½
Johns-Pratt Co	100	......	....	....	90	100
*Pratt & Whitney Co..........com.	100	......	....	....	4	8
*Pratt & Whitney Co............pfd	100	......	....	....	45	50
Stillwell-Bierce Co............com.	..	......	....	....	70	80
Stillwell-Bierce Co.............pfd.	..	......	......	2 % Sept. 1, '97.	96	98
Shultz Belting Co	100	500,000	......	....	60	29
St. Charles Car Co	--	....	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Oct 31, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..........1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112½	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*119½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..........1st 5s	....	....	......	......	*106½	......

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Oct 31, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	118⅛	117
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115⅛	116
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	102¾	103¼
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	115⅛	1 6
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	102½	104
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co.........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s	601,000	580,000	1932	M. & N.	118	120
City & Suburban Ry......1st mtg. g. 5-	3,000,000	3,000,000	1922	J. & D.	115	115¾
Lake Roland Elev...............1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113½
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	120

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104½	104¾
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105½
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	... .	....
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102⅛	102½
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.......1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	105¼	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	59	60
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¼	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	103
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	....	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	105	......
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	107	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	101½
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	95	......
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Oct 31, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	105	105½
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	107¼	108
So. Cov. & Cin. St. Ry........1st mtg. 6s.	250,000	250,000	1912	M. & S.	......	119½
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	....	135

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Oct 31 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	106	107
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	105	105¼
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	104	104½
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	103	104½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	8,835,000	1905	A. & O.	97½	98½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	105	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	104	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 5	100,000	94,000	1909	M. & S.	102	......

New Orleans La.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR.............1st mtg. 6s.	....	50,000	1899	M. & N.	101	.....
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83	83½
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	....
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	104	104½
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	......	....
‡St. Charles St. RR. Co......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	105	....

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	109½	110½
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	120	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111½	114
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	104	105½
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	115
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	85	88
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109½	110½
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	103	105
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	104	....
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	102½	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111	112
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	......
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115¾	116½
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100½	102¼
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115½	117½
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	97	99
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	123	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1[illegible],500,000	1997	F. & A.	114⅞	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	114½	115
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	108½	......
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	124½	......
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	114½
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111½	112½

†$1,085,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.....................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Oct 31, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry...........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	....	1943	....	105	......
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s.	....	....	1905	....	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	94½	......
Central Traction Co...............1st mtg. 5s.	375,000	375,000	1930	J. & J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	116¼
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	112½	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg...............5s.	750,000	750,000	1928	M. & N.	......	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	107½	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	111	......
Second Ave. Traction Co......................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	108	109

St. Louis.

Date of Quotation—Oct 31, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1918	J. & J.	111½	112½

*With interest. *Un listed.

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Oct 31, 1898.						
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co.........................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co..............................	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co..............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	103
People's RR. Co.....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co.....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co...............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co....................1st mtg. 5s.	2,000,000	2,000,000	1910	M. & N.	100½	101½
§St. Louis & Sub. Ry...........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	101½	102½
St. Louis & Sub. Ry................Income 5s.	800,000	800,000	....	....	60	65
††Southern Electric Ry.....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	112	113
Union Depot RR. Co.....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co...........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	114½	115½
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Oct, 1898.						
California St. Cable RR......1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	116½	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	......	116½
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	94	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	127½	129
†Metropolitan Ry. Co........................1st mtg.	200,000	....	....	....	......	......
†Omnibus Cable Co..................1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	128½	130
†Park & Cliff House RR.........1st mtg. 6s.	350,000	350,000	1912	J. & J.	106	....
†Park & Ocean RR...................1st mtg. 6s.	250,000	250,000	1914	J. & J.	112	......
†Powell St. Ry........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	119	120
Sutter St. Ry. Co..................1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Oct 31, 1898.						
Belt Ry. Co. ....O..s mtg 5s.	500,000	450,000	1920	J. & J.	......	....
Columbia Ry........................'' mtg. 6s.	500,000	500,000	1914	A. & O.	122	126
Eckington & Soldiers' Home. mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	125	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Oct 31, 1898.						
Bridgeport Traction Co..........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	100	105
Buffalo (N. Y.) Ry. Co........Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	115	116
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	110¼	111¾
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & D.	98	101
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	108	108¼
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	100	102
Denver City Cable Ry.........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	115	115½
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	96	100
††No. Hudson Co. Ry. (N. J.).Cons. mtg. 5s	8,000,000	2,378,000	1928	J. & J.	103	104
No. Hudson Co. Ry. (N. J.)...2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)..........Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	99	101
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937		90	92
St. Paul City Ry....................Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Oct 31, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	103	....
Pittsburg, Pa.						
Date of Quotation—Oct 31, 1898						
Allegheny County Light Co................6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1913	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	......	......
Miscellaneous.—(Oct 31, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	110	115
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	....	116¼	117
Edison Elec. Illg. Co. (Brooklyn).........	2,500,000	1,500,000	1940	....	110	115
Edison Electric Light (Philadelphia)..	2,000,000	......	......	....	....	......
Edison Illg. Co. (St. Louis)..............	4,000,000	....	1928	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	......
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	....	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Oct 31. 1898.						
American Bell Telephone...................7s.			1898	F. & A.	101¾	....
Northwestern Telegraph Co...............7s.	....	......	....	......	......	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	....	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	......

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Oct 31, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co...............	....	....	....	....	......	25
Barney & Smith Car Co..................†6s	....	....	1942	J. & J.	97	100
Carborundum Mfg. Co.....................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co...........	75,000	......	......	......	..	..

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12⅜c.; Lake, 12½c.; casting, 12⅛@12¼c.

The Consolidated Traction Company of Pittsburg, Pa., has declared a dividend of $1.50 per share on its preferred stock, payable November 14.

The Coney Island & Brooklyn Railroad Company has declared a quarterly dividend of 2½ per cent. This is an increase in the rate of 2 per cent. per annum.

Beginning on November 1, the dividend rate on stock of the Metropolitan Street Railway Company of Kansas City, Mo., was increased from ½ to 1 per cent. quarterly.

The American District Telegraph Company of New York has declared a dividend of 1 per cent., payable November 15. Transfer books close November 7 and reopen on the 15th.

A dispatch from Columbus, O., states that the earnings of the Columbus Street Railway for the third week in October were $14,220.17, or $2,946.52 more than the earnings for the same time in 1897.

The Erie Telegraph & Telephone Company has declared its quarterly dividend, No. 60, of 1 per cent., payable November 21. Transfer books close November 12 and reopen November 21.

The gross earnings of the Brooklyn Rapid Transit Company for the year ended September 30 were $5,912,891; net earnings, $2,195,270; gross income, $2,438,151; surplus, $368 220.

A local financial paper states that the General Electric Company refused the Manhattan electrical equipment contract because of the demand for a security bond of three times the amount involved.

A charter has been granted by the Secretary of State of West Virginia to the Edison Junior Electric Light Company, with the privilege of increasing the capital stock from the amount subscribed ($100) to $500,000.

The Kings County and Brooklyn elevated roads are reported to have come to an agreement whereby the former will use the tracks over the Brooklyn Bridge for $83.33 a day, running half as many trains as the Brooklyn Company.

The directors of the New England Telephone Company have declared the regular quarterly dividend of $1.50 per share, payable November 15 to stock of record October 31. Transfer books will be reopened November 14.

The New York Stock Exchange has listed the $2,551,200 new preferred 7 per cent. cumulative stock of the General Electric Company, that being the total amount of the preferred stock as reduced to 60 per cent. of the original issue.

The stockholders of the West Roxbury & Roslindale Street Railway Company, West Roxbury, Mass., will increase the capital stock of $100,000 for the purpose of funding the floating indebtedness and extending the company's tracks.

Judge Badger has issued an order of foreclosure against the Columbus (O.) Central Street Railway, at the instance of the Cleveland Savings & Trust Company, which holds a mortgage for $1,500,000 on the property. G. W. Worthington of Cleveland will conduct the sale.

An additional $227,000 of first mortgage gold 5s of the Brooklyn Rapid Transit Company has been listed by the New York Stock Exchange, making the total amount listed to date $6,625,000. The Exchange has also listed $2,255,000 first consolidated mortgage gold 5s of the Brooklyn, Queens County & Suburban Railroad bearing the guarantee of the Brooklyn Heights Railroad Company.

Among the bills recently introduced in the councils at Philadelphia and referred to committees was one granting permission to the Standard Telephone & Telegraph Company to construct and operate a separate underground system. According to the bill, ninety days after its passage the company must submit its plans, and the work is to be completed in four years, and also a bond of $50,000 shall be filed.

The New York Stock Exchange authorized that $2,000,000 additional capital stock of the Third Avenue Railroad Company be added on November 2, 1898, to the amount already on the list, making a total of $12,000,000 of stock listed. The proceeds as stated are to be used for the purpose of providing funds to change the cable system to the underground electrical system upon the Third Avenue, 125th Street and Tenth Avenue lines. The new stock was offered to stockholders at par.

On the 28th ult., in Dubuque, Ia., Judge Shiras, of the U. S District Court, in the suit of the Old Colony Trust Company of Boston against the Dubuque Light & Traction Company, rendered a decision in favor of Doan & Co., former owners of the Eighth Street Railway, holding that the latter is entitled to recision of the contract by which the line was sold to the traction company. The suit was one of several involving property valued at half a million.

The Newport News and Old Point Comfort Railway & Electric Company on the 26th ult. closed a deal by purchasing the property of the Newport News, Hampton & Old Point Electric Railway Company. A mortgage was given to the Maryland Trust Company to secure $900,000 worth of 5 per cent. gold bonds. W. J. Payne of Richmond is president, and W. A. Post, general manager of the Newport News Shipbuilding & Dry Dock Company, is vice-president. M. E. Ingalls is one of the largest stockholders in the new company and his name appears as one of the directors.

The Illinois Supreme Court has decided that the city council of Chicago has the power to compel compensation for street railway franchises. The decision was given in the appeal of the Chicago General Railway Company against a judgment of $2,250 given the city in a suit to recover damages on the bond of the company. The ordinance granting the right of the company to operate a street car line imposed an annual license fee of $500 for every mile of track. The company protested against the payment of this fee. The Supreme Court upheld the right of the city to impose such a fee, and made the broader interpretation of the law that the city council could insist upon compensation for the use of the streets.

An investor in the securities of the Edison Electric Illuminating Company of New York is quoted as saying: "I am not at all disturbed by the rumors that the Metropolitan Company or the Third Avenue Company are going into the electric business. Even if they do the Edison Company can, in my opinion, maintain its position. The company is likely to have net earnings this year approximating $1,200,000. After deducting fixed charges there should be considerably more than $800,000 available for the stock, which will make a very handsome percentage of earnings."

The Denver "News" says: "The entire system of the Denver Tramway Company will be operated by electricity generated at the coal mines in the Lafayette district by early next spring. The officers of the Tramway Company deny this 'officially,' but steps are now under way for the formation of a company composed largely of Tramway and coal trust owners who will erect at the coal mines an immense steam plant which will furnish power for the generation of thousands of horse-power of electricity which will be brought to Denver and used on the company's lines. At various times within the past three months the fact has leaked out that there was to be a large power plant installed in the coal field, but only within the past few days has the matter taken definite shape, and so far along has the plan gone that it is a certainty that work will be commenced during the winter and the pole line completed by spring."

ELECTRICITY.

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CONTENTS.

EDITORIAL NOTES.

Electric Street Railways of New York City. The cable as a method of propulsion for street railway cars in New York City is apparently doomed, and will shortly be superseded by electricity, just as horse-car lines were supplanted by the cable roads about four years ago. The general adoption of electricity as a motive power for the street railways of this city is undoubtedly a good thing so far as the comfort, convenience and safety of the citizens are concerned. Some three years ago the Metropolitan Street Railway Company built an electric conduit line along Lenox avenue, more as an experiment than anything else, all previous attempts at electric conduit traction both in this country and abroad, with but one exception, having proven dismal failures, and so skeptical was the company of obtaining satisfactory results from an engineering and financial standpoint that the line was built in a most substantial manner, supported on heavy iron yokes, thus enabling the road to be readily converted to a cable system if found advisable.

The very fact that the road was built in so substantial a manner contributed materially towards its successful operation, and the company was encouraged to introduce underground electric traction on its Madison, Amsterdam, Second and Eighth avenue lines as well as on its Fifty-ninth street line. At the present time the work of installing the underground trolley is being rapidly prosecuted along Sixth avenue, and already electric cars are in operation on that line as far down as Fourth street. Still more recently the necessary steps have been taken looking to the introduction of electric conduit traction along Broadway, the work of laying conduits for the feeder cables being pushed rapidly from both Fifty-ninth street and Bowling Green. About the only other change in the Broadway line which it will be necessary to make in order to convert it from cable to electric will be the placing of handholes in the conduit at intervals of fifteen feet to hold the insulator boxes.

The Third Avenue Railroad Company also has begun the work of changing its Third avenue cable line to an electric system and contemplates installing a similar system on its Boulevard line, which is at present operated by horses. With all these important changes either already begun or shortly to be undertaken, another year should see about the last of horse and cable traction in New York city. That the underground trolley system possesses many advantages over the cable is not to be doubted, as an electrically propelled car is at all times directly under the control of the motorman and may be run either forward or backward at will, whereas a vehicle drawn by cable cannot be driven backward, which is a decided disadvantage in crowded thoroughfares such as are frequent in this city. Another serious objection to cable traction is the fact that at times as many as several hundred cars are all depending on a power station engine to be kept in motion, and should any unforeseen accident occur, as frequently happens, requiring the shutting down of this engine, all the cars along the line are stalled. Furthermore, by the use of electrically operated cars there will be no opportunity of a grip's catching a loose strand of cable, resulting in collisions and other accidents. The principal reason, however, why the cable is being so rapidly discarded in behalf of electricity would seem to be owing to the fact that an electric conduit system has been found more economical to operate than any other system.

According to an article which recently appeared in the *Street Railway Journal* giving the relative cost of operation of cable, electric and horse railways in New York City, as determined by the Metropolitan Street Railway Company for a year, cable lines averaged 16.42 cents per car mile, horse lines 17.87 cents and electric lines 10.23 cents. This low cost of operation of electric lines per car mile may partially be accounted for in the greater speed made by electrically propelled cars and consequent reduction in cost of labor.

The public press has lately taken up the question of the braking of the new electric cars now in operation, claiming the devices now in use for quickly stopping a car are inadequate and are moreover responsible for a number of accidents which have recently occurred. Commenting on this subject, a recent issue of the New York *Herald* says:

"This brake does not vary in principle from, and to outward appearances is identical with, the familiar twisting brake that has been in use on horse cars for more than half a century. It served its purpose fairly well in stopping horse cars, but while the motorman is twisting his old fashioned brake his ponderous car plunges on with hardly a check to its speed. It would be about as reasonable to depend on the old hand brakes operated from the car platforms in response to the whistle for the control of the Empire State Express."

Although many improvements have been wrought in the old form of hand brake referred to in the above paragraph, this question of providing suitable mechanism for checking the speed of the long and heavy cars now coming into use will have to be taken up and dealt with most thoroughly. It would seem unquestionably true that the improvements in braking have scarcely kept pace with the increase in weight and length of cars, although

there are several electric brakes patented—in fact in actual use—which might be advantageously adopted by the Metropolitan Street Railway Company for controlling its cars.

* * *

A Long-Distance Transmission Plant.

The generating of electricity by means of water power to be transmitted at high voltage over long distances is by no means confined to California, Niagara and Switzerland. The city of Victoria, in British Columbia, is now lighted by electricity and has also an electric street railway in operation by means of power transmitted over a long stretch of wire. The work of conducting power for these purposes from what are known as the Sooke Mountains was completed during the month of August. Sixteen miles from Victoria the waters from what is claimed to be the highest fall in Canada, with an elevation of 2,300 feet above the sea, form a lake with an area of over one hundred acres into which empties Goldstream River. This river is tapped some three miles from its source to form an artificial lake or reservoir covering about seven acres. From this reservoir a steel pipe thirty-three inches in diameter and 6,700 feet in length has been laid, through which the water for operating the turbines passes. As the power station is at an elevation of but 460 feet above the sea a head of 1,000 feet is obtained.

The practically inexhaustible supply of water is regulated by automatic governors, ensuring steady action of the dynamos. In the power house, located at the foot of a mountain, is an electric plant said to be without a rival for size and completeness on the North Pacific Coast. From the power house the electric current is carried by six copper wires, twenty-one hundredths of an inch in diameter, twelve miles to the city, and furnishes power sufficient to operate not only the street car and electric lighting system, but factories as well.

* * *

Electricity in Japan.

Of all the nations of the world, Japan during the past quarter of a century has probably progressed more than any other. Fifty years ago that country ranked with China in conservatism, adhering to antiquated methods and customs which had been in vogue practically without change for centuries. Machinery, in the modern sense of the word, as an aid to labor was unknown, everything in the industrial line being done by hand. Western ideas and improvements were most carefully excluded, it being generally thought that any innovations would be immediately followed by ruin.

In 1854, however, after repeated efforts, Japan was opened up for the first time to Western commerce through the medium of a treaty brought about by Commodore Perry. This caused an internal revolution which was the means of preventing the introduction of any degree of civilization into Japan until 1870. Dating from this period, however, Japan has not been slow to avail itself of modern methods, and in no line is this more conspicuous today than in that pertaining to electricity. The principal cities throughout the Japanese Empire are in direct communication one with another by means of numerous and well-equipped telegraphic lines, while in some of the larger cities such as Tokio and Yokohama telephones abound. As an illuminant electricity is also rapidly becoming popular. Tokio, the capital of the empire, occupying an area of 100 square miles and having a population of about 1,400,000 inhabitants, has been lighted by electricity for a number of years and now has a most complete and up-to-date lighting plant. The latter is equipped with ten triple expansion condensing engines, which operate a number of single-phase and three-phase generators wound for 2,000 and 3,500 volts respectively. In the thickly settled portion of the city current for lighting is distributed by means of the Edison three-wire system from sub-stations where induction motors have been installed.

In the matter of electrical street railways Japan would seem not so well off as in lighting. There are at the present time but about 60 miles of street railways all told in the empire, of which but two lines, those of Kyoto and Nagoyo, are operated by electricity. A number of other electric roads are said to have been projected in different cities and towns throughout that country, none of them however having as yet materialized. For that matter the hesitancy shown by Japan regarding the introduction of the trolley has until very recently been exhibited by several supposedly much more enlightened nations in Europe. If the rumor which is at present afloat is to be credited, the near future should find Japan a network of electric street railways. According to the public press the Japanese Government has recently made a proposition to a well-known electrical concern in this country, looking towards the installation and operation of electric street railway lines and lighting plants in all parts of that empire. With this object in view a syndicate is now being formed, so it is alleged, with a capital of $10,000,000 to prosecute the work. Whether this proves to be the case or not, one thing may be depended on, and that is that in the near future the Mikado's realm will be amply provided in one way or another with up-to-date methods of transportation.

Under the Searchlight.

Notes and Comments on Various Topics.

SOME of the methods introduced in the tunnel boring for the Jungfrau Railroad in Switzerland, in order to meet the exigencies peculiar to the extreme winter weather, are of special interest to engineers. On this work blasting gelatine is used, an explosive which freezes at about 40° Fahr., and, in its frozen condition, is very dangerous to handle, being unlike dynamite in this respect. It seems that the contractors who are blasting out the Jungfrau tunnel keep their explosive in a sort of safe heated by electricity, so that any danger of the gelatine freezing is entirely obviated. Dynamite, or some other derivative of nitro-glycerine, is in very common use for blasting and other purposes, and is commonly frozen for safety. It is usual to thaw it out before it is used, but frequent accidents thus occur, and it is thought that a dynamite thawer operated by electricity would be alike safe and convenient.

* * *

THE fair telephone operators in New York City probably do not appreciate what similar operators in other countries have to endure for even less wages. In Vienna, for instance, the telephone girls are required on arriving at the exchange in the morning to change their dresses and wear a uniform while on duty. This precaution is thought necessary as the dust brought in from the street might affect the instruments. The costume consists of a dark skirt and waist with sleeves striped black and yellow—in other words, the Austrian national colors. Imagine telephone girls in this country having to put on the attire of the Goddess of Liberty!

* * *

MR. WILLIAM A. EDDY in a report to General Greely on the results of his kite experiment near the Statue of Liberty says: "Electrical tests of the absorbing power of the statue were made on November 1, 3 and 4. A Leyden jar was used on the last test, and reaffirmed the first discovery that the statue does not influence the air much beyond one hundred feet in a horizontal direction from the statue nor much more than twelve hundred feet in a perpendicular direction above the torch. During the experiment four kites were driven into the water and destroyed."

* * *

WHAT is known as the Wilde prize of 40,000 francs has recently been awarded by the French Academy to Mr. Charles A. Schott, of the United States Coast and Geodetic Survey, for his excellent work in territorial magnetism, and chiefly for the theoretical investigations for determining the variations of magnetic elements. This is the first time the prize has been awarded, and that it should go to an American is decidedly flattering.

* * *

AN electrical beefsteak party was held a few days ago in a restaurant in New York. Prof. G. B. Cary, a French scientist with a gastronomical bent, had invented an electrical grill and brought it to the place to be tested. A few experts in electricity were bidden to the tests. These included editors of electrical publications, electrical engineers and ordinary consumers of electricity on telephone and similar circuits. Steaks and chickens were put between the heating surfaces, and the guests waited for eight minutes for the steaks to cook and thirteen minutes for the chickens, drinking the health of the inventor meanwhile. The new device did its work well so far as the cooking was concerned, but the meats appeared as if they had been baked instead of broiled, and lacked the tempting brown exterior produced by coal or gas heat.

* * *

WHEN Thomas A. Edison's second daughter was born, says the New York *World*, his technical assistants in the laboratory at Orange presented him with plans for a cradle intended to save Mrs. Edison much of the worry and trouble usually experienced by mothers. Several other ideas were submitted to the committee, but the thought of the Wizard ambling up and down the room in the dead of night, occasionally stepping on a semi-submerged tack, was too much for them, so the cradle was decided on. It was called the "automatic electric baby tender." It was an ordinary cradle with ingenious devices for the child's comfort attached. Immediately above the spot where the baby's head would lie was a diaphragm, somewhat like a telephone receiver. If the infant should start crying, at the very first wail communication was established between the diaphragm and an electric clock. At the same time the cradle was set rocking by means of a small motor. If the remonstrance continued beyond a certain time the clock released a lever and an arm attached to the side of the cradle (operated by what is called a bell crank lever), carrying a nursing bottle, was swung over the baby's mouth. If hunger was not the trouble and the wails continued, another arm on the opposite side swung over the child's mouth with paregoric. At the same time the electric current was turned into a set of magnets placed around the cradle, and any pin which might be causing the trouble would be at once removed. If the yells continued, the "thirty-third degree" was applied. Two arms, lying flat in the cradle under the baby, were slowly raised and the child turned over. Then an electric spanker fastened to the footboard proceeded to do its work with neatness and despatch. However, Mr. Edison persists in regarding the baby's joy electric cradle as a joke.

* * *

IT would seem as though a trolley car could be adapted to many uses. A grand stand at the Northwest ball park in Chicago was recently demolished by a mob of men, women and children by the aid of the trolley. The crowd secured a car and attached one end of a rope to a post supporting the roof of the grand stand, while the other end was tied to the car. When all was ready the trolley was started and the big roof fell in with a crash.

ELECTRICAL EQUIPMENT OF A MODEL PRINTING ESTABLISHMENT.*

BY GEORGE A. DAMON.

To even a casual observer the part which electricity is playing in industrial movements is an interesting study. The concentration of great manufacturing establishments about water powers and the opening up of vast suburban districts about our cities by means of the rapidly moving electric car, are every-day instances of the influence of electrical development upon constantly changing industrial conditions. Perhaps less evident, but none the less important, are the changes which are being brought about by the use of the electric motor in the operation of manufacturing establishments. Enterprising manufacturers have not been slow in appreciating the advantages to be gained by the electrical operation of their factories, and we have many instances where the cost of labor and of power has been reduced, or the efficiency of a process has been increased by the use of the electric motor.

There are few instances, however, where the adoption of electric power has led to such a radical departure from ordinary methods, or where greater advantage has been taken of the possibilities of electrical operation, than in the model printing establishment of the W. B. Conkey Company at Hammond, Ind. This great establishment is the result of more than 20 years' development. Starting with a small capital, Mr. Conkey gradually increased the size of his establishment until, about a year ago, it occupied the seven-story Franklin building on Dearborn street, Chicago, and two seven-story structures on Plymouth place, besides a large warehouse on Market street. While quite as successful as many other publishing houses, the operation of this immense plant in the center of a great city presented many disadvantages. Taxes were necessarily high, insurance rates oppressive and the cartage of raw material and finished product to and from the depots through a congested business district was slow and expensive, while its movement by the railroads was unsatisfactory. The mill construction of the buildings, their location with respect to surrounding structures and the extent of floor space employed made it necessary to supply artificial illumination to many parts of the factory during the entire period of operation. The relative location of the buildings made it necessary to maintain two distinct plants for power, heat and light. Power was transmitted from the engine flywheel to the various machines by means of belts, rope drives and pulleys. By actual tests fully 45 per cent. of the power delivered by the engine to the main driving shaft at average load was used to run the shafting, and this transmission loss was, of course, much larger at lighter loads.

A consideration of these disadvantages led the company to seek a new location with more advantageous conditions. A flattering bonus offer from Hammond, Ind., made it possible to secure a factory site with ample room and shipping facilities, and as a result the most extensive buildings for the purpose in the country have been erected and equipped there. Hammond is practically a suburb of Chicago, being connected to it by an electric road and six lines of steam railways. The belt line makes direct connection with fourteen trunk lines centering in Chicago. A special car leaving Chicago every night delivers small local freight upon the shipping platform of the plant at Hammond every morning. With the same freight rates as formerly, it has been found that the cost and time of handling shipments have been materially reduced in the new location.

The plant is located on a stretch of rolling prairie land and the buildings cover about four acres of ground space. A macadamized roadway extends along two sides of the main buildings, while an extensive park, containing artificial lakes, rare shrubbery and artistic flower beds, has been laid out before the main entrance. Hundreds of employes spend their noon hour upon the big playgrounds which surround the factory or wander in the woodland near at hand. But the most unique feature of the plant is the construction of the building. It extends over an area of 520 feet by 450 feet and consists of but one floor. This makes it possible to pay especial attention to the lighting, and as a result the whole roof resembles a vast skylight. The windows of the roof are glazed with frosted glass and are placed at an angle looking toward the north. Every 29 feet of roof space provides 11 feet of light. Owing to the angle of the roof the direct rays of the sun are kept out of the building, which is thus lighted by the soft-reflected rays from the northern sky. It would be hard to conceive of a more evenly or more thoroughly lighted factory building. The entire roof is built up of light structural steelwork resting upon cast-iron columns spaced on 29-foot centers one way and 16-foot centers in the other direction. The height of the trusses above the floor is 12 feet.

The general plan of the plant is shown by Fig. 1. The general and private offices, with the employes' dining, bicycle and wash rooms, are located at the front of the building. The press room occupies a space 116 by 212 in the center of the large structure. The receiving room and shipping room are conveniently located in relation to the side track platform, while the plate vault, electrotype room, composing room, store room and hard and soft bindery surround the central press room. It will thus be seen that the stock passes through the plant with a minimum amount of travel from the receiving platform to the shipping room. As everything is upon the ground floor no elevators are required. The power plant, with its boiler, engine and fan room, is located on the north side of the building convenient to the railroad tracks. Coal is delivered from the cars directly into bins in the boiler room.

The boilers are of the horizontal water-tube type with 3,472 square feet of heating surface and 60 square feet of grate surface per boiler. At the present time two boilers are installed, and the stack is situated so as eventually to be flanked on either side by two boilers of the completed battery of four. The breeching from the boilers to the stack is of sheet steel.

The stack is a self-supporting steel chimney 125 feet high and 54 inches diameter inside the gas flue. The courses for the first 30 feet from the top are made of three-sixteenths-inch plate, for the next 30 feet of one-fourth-inch plate, for the following 40 feet of five-sixteenths-inch plate, while the 25 feet coned base is made of three-eighths-inch plate. The stack is held in place by eight $1\frac{7}{8}$ inch bolts bedded in a foundation of concrete. A unique feature of the stack is the method used of inverting each section so that the top end of each section rests outside the section immediately above it. This prevents the soot washing through the joints and down the outside of the stack, as is too frequently the case with steel chimneys.

BION J. ARNOLD.

Consulting Engineer of the W. B. Conkey Company's Model Printing Establishment.

The engine upon the left end of the row of generating machinery is an $11\frac{1}{2}$ inch by 18-inch by 36-inch tandem compound non-condensing Corliss engine and runs at 125 revolutions per minute. This speed is rather high for a Corliss engine, but indicates the tendency of modern practice where the engine is directly connected to a generator. When properly designed there seems to be little reason why an engine with independent valves should not be run at this speed, and if successful at this number of revolutions per minute, we probably will not be satisfied until the speed is again raised. As long as the cost of electric generators of a given size increases in proportion as their speed is decreased, there will be great pressure brought to bear upon engine builders to produce a successful engine of the Corliss or similar type running faster than the ordinary 80 to 100 revolutions per minute. For purposes of power plants of this character the Corliss type of engine, in the minds of a great many engineers and purchasers, has advantages of economy in steam consumption and low cost of maintenance which engines of the high-speed type do not possess. The objection when directly connected to a generator is the cost of the unit.

This engine is fitted with double eccentrics and governors on both cylinders, the governor being of

* Read before the Chicago Electrical Association, November 4, 1898.

the Porter type. The special design of the double-ported admission valves permits a quick cut off, while the operation of the steam and exhaust valves by separate eccentrics gives the engine a long range of cut off and a large reserve capacity for overloads. The flywheel is made in halves, weighs 16,000 pounds and is 12 feet in diameter, giving a peripheral speed of 4,700 feet per minute. With 120 pounds initial steam pressure and a back pressure of three pounds the engine is rated at 160 indicated horse power and is guaranteed to develop each indicated horse power hour on a consumption of 21 pounds of steam. It

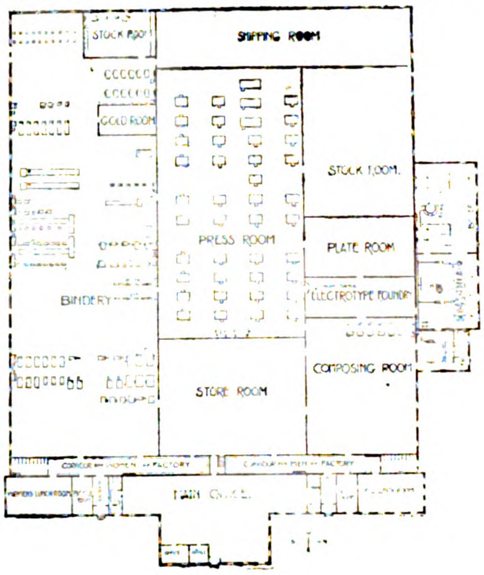

FIG. 1.

has an economical range of power between 100 indicated horse power and 225 indicated horse power, but is designed in all its parts to operate continuously on an overload of 100 per cent., or at 320 indicated horse power. Provision has been made in the piping to secure this overload by admitting high-pressure steam to the low-pressure cylinder. The conditions under which it may be expected to operate in this manner and at this unusual overload will be referred to later. The shaft of the engine is of open-hearth forged annealed steel. It projects through the outboard bearing a sufficient distance to carry a flange forged solid on the end of the shaft. This flange is to carry a coupling which connects the engine shaft to the generator shaft. Between the high and low pressure cylinders and in a pit beneath the floor of the engine room is a receiver fitted with reheating coils and provided with the necessary traps for returning the condensed water to the boiler.

The generators are compound wound and are designed to deliver 100 kilowatts output at 225 volts when running at 125 revolutions per minute. The field frame is split through the center on a horizontal plane, so that the upper part can be removed. This operation will not be necessary, however, in case repairs are required on the armature windings or field coils, as provision has been made to slide the entire armature frame parallel to the shaft, along cast-iron footings, a sufficient distance to clear the armature. The armature is of the iron-clad type, with a commutator of ample proportions. The brushes are of carbon and the brushholders are carried in a circular iron frame arranged to be moved by means of a threaded rod and a hand wheel, so that the position of the brushes may be adjusted. The field frame has eight poles and the compounding coils are provided with an adjustable shunt, so that the over-compounding may be adjusted over a range of from one to five per cent.

The arrangement of the machinery in the power plant is shown in Fig. 1. It will be seen that this plan calls for two engines and three generators. The second engine is also a tandem compound, non-condensing engine, but is of the center-crank type with overhanging flywheels. This engine is of twice the horse power of the side-crank engine; that is, it can develop sufficient power to operate economically two of the 100-kilowatt generators, though when necessary it will be able to operate all three of the generators.

The whole line of machinery is connected on the "Arnold system" of power-station construction. In this system each generator armature is mounted in such a way as to be perfectly independent of the remaining machinery, and by means of a suitable coupling can be put in operation or thrown out of service at will. The shaft upon which each generator armature is mounted is made hollow, so as to allow a solid shaft to be carried through it. This solid shaft is supported in two independent bearings near its middle and extends from engine to engine, but under normal operating conditions it is independent of the engines and of the generator shafts and lies idle in its bearings. Each end of this shaft is provided with a suitable coupling, so that it can be operated by either engine or by both working in unison. The result of this ingenious arrangement of shaft, hollow quills, bearings and couplings is that each generator can be operated by more than one engine. In a plant arranged with direct-connected units this feature is a decided additional advantage, for the units can be operated in much the same manner as in a belted plant. Ordinarily in a direct-connected plant the crippling of a generator will shut down its driving engine, or if an engine breaks down its contiguous generator must necessarily be taken out of service. The Arnold system obviates this disadvantage, and the result is that reliability is secured in the operation of the plant with much less reserve machinery than is ordinarily required. The arrangement may look complicated, but in reality it is simple, and for the advantages it secures it is comparatively inexpensive.

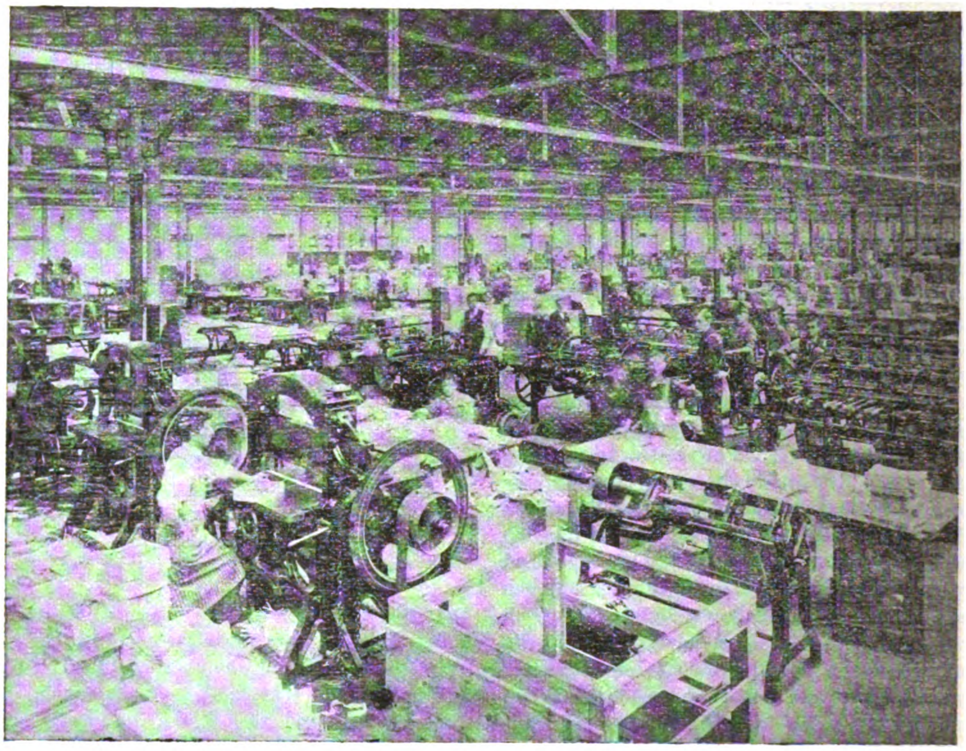

FIG 2.

The method which has been adopted to provide for an increasing demand for power in this plant may prove of interest. At the present time engine No. 1 and generator No. 1 have been installed and are now handling the load. A smaller 50-kilowatt high-speed unit is being placed in position for the purpose of carrying the load when the press room is working all right. It may also be used to furnish current for the lighting circuits when the combined power and lighting load becomes too large for the Corliss engine and 100-kilowatt unit. Eventually as the load is increased in size, engine No. 2 and the two additional generators will be installed, and the plant will then be ready to furnish economically all demands for power over a range of from 75 horse power to 525 horse power. It will be capable of handling a load of 400 horse power, with a reserve unit for operation in case of accident. For instance, if the larger engine should get out of order the smaller engine could be connected to both generators No. 1 and No. 2. The provision for admitting high-pressure steam into the low-pressure cylinder and the capability of the engine for standing an overload have already been mentioned. By taking advantage of these arrangements the smaller Corliss engine can be made to double its rated horse power and carry the load of the larger engine. To secure the same reliability and wide range of economical operation with an ordinary direct-connected plant would require four separate engine units, which would not only be more expensive in first cost, but would require larger foundations, greater floor space and more piping, as well as demand a larger amount of attention in operation.

The engine and generator foundation consists of a solid monolith of concrete eight feet deep and of sufficient width to give ample footing for the machinery. Water-tight iron pipes run through this foundation and under the cement floor of the engine room to the back of the switchboard for the purpose of carrying the generator leads. These leads consist of stranded rubber-covered and braided lead-encased cables of 600,000 circular mils cross section area.

The switchboard is of highly polished black enameled slate, $1\frac{1}{2}$ inches in thickness, with the usual indicating and regulating instruments. Separate omnibus bars are provided for the power circuits and the lighting circuits. Each generator is furnished with two main switches, by means of which it may be operated on either the light or the power circuits, or upon both at the same time.

Each feeder leaving the board passes through a fuse, the fuses being fastened in a row upon a special fuse block at the top and back of the board. From this block the feeders pass directly through the wall of the engine room into the factory. The power and lighting distributing system throughout the plant are independent of one another. In the factory two main distributing centers are located in a central position, one on the north wall of the bindery and the other on the north wall of the press room. The centers consist of small switchboards fastened to the side of the wall and surrounded with a hardwood asbestos-lined cabinet. Their main bus-

bars are connected back to the switchboard by means of large feeder cables. At each center a separate cabinet is provided for the lights and power, the various circuits leading to the different parts of the building leaving the distributing board through suitable switches and fuses. The main feeders are carried along the wall of the electrotype foundry to the press room. From here they are carried on the under side of the iron roof truss by being supported on porcelain insulators fastened to iron beams, which are firmly bolted up against the angle iron of the roof. The distributing circuits are carried upon porcelain insulators attached directly to the under side of the wooden roof beams and above the iron trusses. All the feeders and mains are thus installed in the "open work" style of construction. A workmanlike job has been done, however, and the wiring presents a very neat appearance.

The leads to the various motors and the wires to the arc lamps and switches are carried in iron-armored insulated conduit. In the case of a press motor, for instance, a porcelain cutout in a suitable box is placed at the top of an iron column 12 feet from the floor. From the bottom of this cutout box a single run of conduit is led down the side of the column, and thence along a groove in the floor to the motor. All the wiring about the presses, between the main switch, the controller and the motor is carried in iron conduit in such a way as to be thoroughly protected from mechanical injury.

The lighting of the plant is accomplished by means of constant-potential enclosed arc lamps. Experience has shown that a very satisfactory illumination

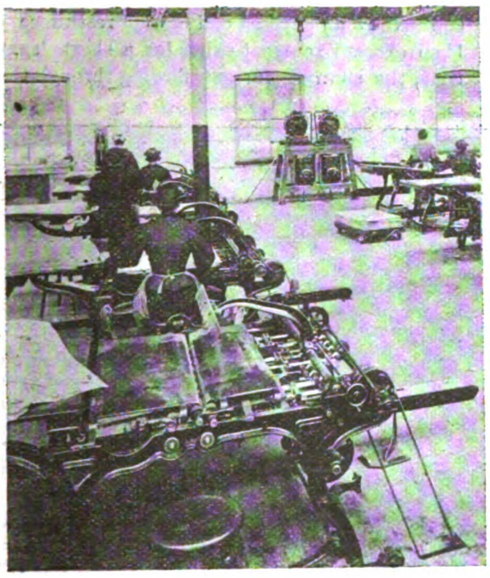

FIG. 3.

can be obtained by hanging a lamp in the middle of each bay and from every other roof truss. This makes each lamp supply light to a floor space 29 by 32 feet. When better illumination is required for any special work, incandescent drop lights are placed, and sometimes, as upon the presses, portable incandescent lamps with an allowance of cord are provided for work requiring occasionally a temporary light.

The arc lamps are controlled by double-pole, 220-volt snap switches carried on slate bases securely attached to the side of the iron columns. The wiring to and from the switches and to the arc lamps is run in iron-armored conduit fastened to the columns and to the under side of the roof trusses. At every lamp opening the conduit contains a tee looking down, and to this tee is screwed a short nipple carrying a hook upon which the lamp is hung. By this method of installation the wires are entirely concealed. Each set of four lamps is protected by a cutout placed in a manner similar to the ones protecting the motor leads.

There are installed in the plant at the present time a total of 95 motors, distributed as follows:

	H. P.
Electrotype Foundry.	
17 individual motors, belted or geared to dovetailing machine, trimmers, planers, roughers, saws, routers, black leaders, molding machines, beveling machines, blowers and jig saws	21
1 direct-connected to electroplating dynamo.	10
Bindery.	
15 belted to shafting, driving folders, book-covering machines, trimmers, sewers, wire-stitchers, sewing machines, case makers, embossers, rounding and backing machines	52
2 direct-connected to shafting, driving cutters and smashers	10
8 individual motors belted to knife grinders, tying machines and gluing machines	18 5
Stock Room.	
2 belted to shafting driving cutting machines, rotary board cutters, grinding machines, sizing machines and bevelers	6
Heating Apparatus.	
1 belted to blower fan to heat office	12
Machine Shop.	
1 belted to line-shaft driving machine tools.	10
Composing Room.	
1 belted to shaft driving typesetting and distributing machines	3
Press Room.	
6 belted to job presses, ink grinders and bronzing machines	5.5
41 directly attached to presses	173
Total horse-power of motors installed	321

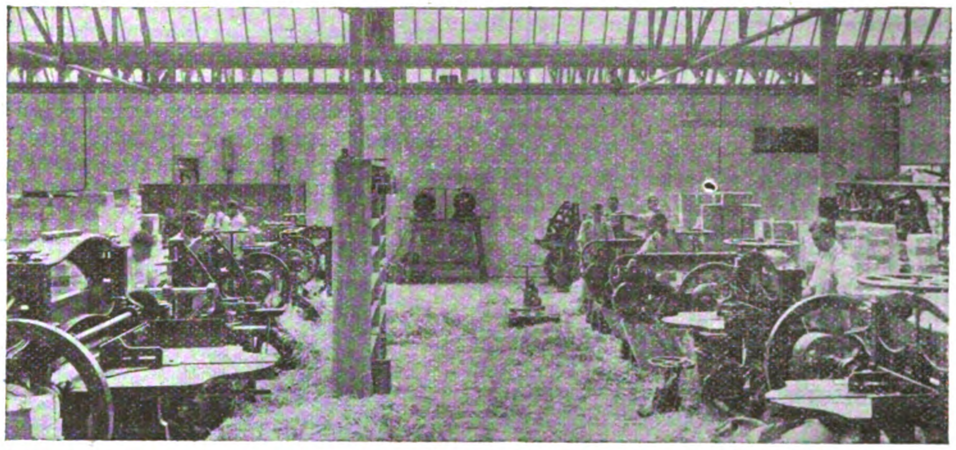

FIG. 4.

The motors throughout are of the Lundell type. This motor is made with one field coil, which is entirely protected by the form of the field casting. The armature is of the ironclad type with removable form-wound coils. The motors have a steady neutral point of commutation and do not spark under sudden changes of load.

The motors directly attached to the presses and shafting are multipolar, narrow in width, with a relatively large circumference of field frames. The commutator, like the armature, is narrow and of large diameter, with a large number of bars.

There are various considerations which usually determine in each case whether a motor should be belted, geared or directly attached to a machine, or perhaps indicate that the machine should be grouped with others of its class and driven from a common shaft. For instance, there are certain classes of machinery, such as folders, stitchers, type-setting and type-distributing machines, etc., which take but a very small amount of power, which are each in operation almost continuously and which can be arranged in rows convenient to a line-shaft. There are few if any advantages to be gained by driving such machines with individual motors, and especially is this the case when the driving shaft can be placed below the floor, as is done in the plant under consideration. Fig. 2 shows a number of groups of this class of machinery. The machine belts pass directly down through the floor to pulleys carried upon a shaft supported by floor stands bolted to planks in the bottom of the shaft pit. This pit is built with a concrete bottom and brick side walls, and is covered with the floor built in sections, so that it can be removed for purposes of inspection and oiling. The shaft is driven by a belted motor set upon a stand at the wall end. This motor rack is made of three by three timber, securely bolted together, and fastened to the floor. Underneath the motor and between the legs of the rack is placed the starting box. This box is mounted on a slate base, which also contains the main-line switch and the fuses for the protection of the motor. Each box is also provided with an overload attachment which will break the circuit in case of an excessive current. As a rule the motors belted to a line-shaft in this way are shunt wound and run at a speed of 1,000 revolutions per minute. Typical arrangements of this character are shown in Fig. 3.

It may seem strange, in view of the admitted losses in line shafting, that any shafting whatever was allowed in the plant, but when the inefficiency of very small motors and their comparatively large cost of installation are considered, reasons will not be found lacking for putting a limit on the tendency toward individual machine driving. In some cases, such as paper cutters, smashers or embossing machines, which depend largely upon the inertia of their moving parts to furnish the power for their operation, a great advantage is gained by having a number belted to a line-shaft, and thus operated by a common source of power, for under such conditions each machine gets the benefit of the stored momentum of the flywheels of the entire line. A case in point is shown in Fig. 4 which illustrates a row of cutters. Here are six cutters and a book-binding machine operated by one five-horse-power motor. Individual driving would have required at least seven one-horse-power motors, and the result would have been far from as satisfactory or economical. On the other hand, there are machines which may take a small amount of power, but which are in operation only intermittently, or perhaps cannot be conveniently located in positions to be belted to a line shaft. Such instances are found in the electrotype foundry, where there are numerous small machines, each with its individual motor either belted or attached by gearing.

The method of driving the large presses, however, presents the most problems. Here the conditions of operation leave but little doubt that individual motors should be provided. But whether to belt, gear or direct connect the motor to the press is the problem. The belted equipment is the cheapest, the easiest to buy and install, and the more convenient to repair, as an injured motor can be quickly replaced. The higher speed at which they run furnishes a certain amount of inertia to carry the press over the "centers" of each impression. The belted motor takes up valuable room, however, and as it must be protected it usually presents an unsightly appearance. The geared motor can be installed in most cases and is an improvement over the belted type, though the increased cost of its installation makes its advantage a doubtful one. The directly

connected motor takes the place occupied by the driving pulleys of a belt-driven press, and thus has the advantages of neatness and compactness. As presses are usually built, the main driving shaft makes five revolutions to every impression, so that a press operating at 1,440 impressions per hour requires a direct-connected motor running at 120 turns per minute. This slow speed means a large and comparatively expensive motor. Its armature must be keyed directly to the press shaft, and this often means that the shaft of the old press must be taken out to have an extension welded upon it. The slow speed of the armature prevents the accumulation of energy to help the press over the centers. In spite of these disadvantages, however, the improvement in the mechanical design of the equipment with direct-connected motors over the belted or geared arrangements, and the longer life of the slower running motors were thought to be sufficient to justify the extra investment, and therefore motors directly connected to the 41 presses were installed.

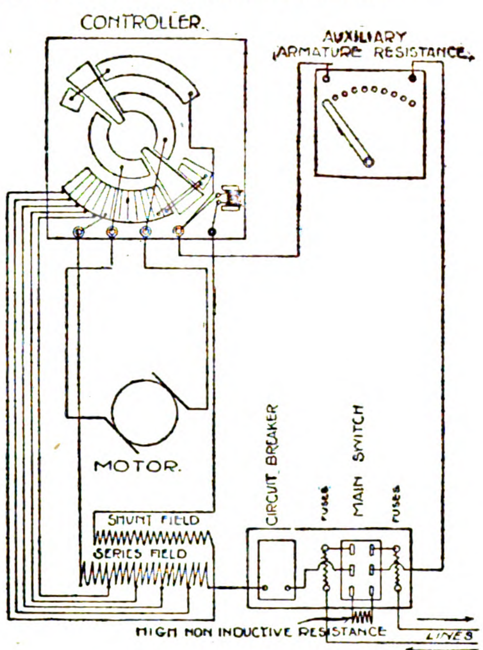

FIG. 5.

The control of the press motors presents a number of difficulties, and the solution which has been worked out in this case may prove of interest. A printing press controller should have a handle placed within easy reach of the feeder, by means of which the press can be conveniently started and stopped. In case of a failure of the current from any cause, the controller should be automatically released so as to return to the "off" position. It should have a locking attachment so that the pressroom foreman can adjust the press for a certain number of impressions per hour and then leave its operation to the feeder. This locking device should not interfere with the stopping or starting of the press, but should insure that while the press is in operation it will be running at the predetermined speed. With ordinary electric press controllers the convenience with which the feeder can change the speed of his motor is a temptation to "soldier" when not working directly under the eye of the foreman. The controller should provide for at least two back-up speeds and should have a handle on the side of the press opposite the feeder, by means of which the press can be run slowly in either direction in "making ready" operations.

The most important requirement, however, is to secure a wide range of speeds for the press. For instance, it is sometimes desirable to be able to operate a press at a number of speeds ranging between 1,000 and 2,000 impressions per hour. This means that the motor should be controlled between 84 revolutions per minute and 168 revolutions per minute, or that its lowest speed should be 50 per cent. of its highest speed. Now, the speed of an electric motor may be varied in three different ways: (1) resistance may be inserted in series with the armature, (2) the intensity of the field magnetism may be changed, or (3) the external potential applied to the motor may be altered. The first method is uneconomical and unsatisfactory in operation, as it results in an unsteady speed under such a variable load as is given on a printing press. The second method, while more economical than the first is limited in its application, for the speed of a motor cannot be satisfactorily controlled in this manner beyond the limits of about three-quarters of its full speed. To extend this range of speed and insure sparkless operation at the higher limits when the field is weakened, a large and expensive motor will be required. The third method requires complicated generating machinery and distributing circuits, and if but two voltages are used (one double the other) the system will not secure the range of speed desired.

The system of control adopted for this plant combines the first two methods. Between full speed and 75 per cent. of full speed the speed variations are secured by changing the field magnetism. This is accomplished by cutting in or out sections of the series field winding. Between three-quarters speed and one-half speed the various steps are secured by inserting resistance in the armature circuit. Three-quarters speed is taken as the average or normal speed of the press, and at this point all series field coils are cut out, and the motor is operated as a straight shunt machine with no resistance in series with its armature. In this way the main controller provides for ten variations in speed, five of which are secured by armature resistance and five by field commutation. An auxiliary resistance box is placed on the motor or adjusting side of the press, by means of which 10 additional speeds can be obtained between any two of the main controller speeds, so that this method of control secures 100 different speeds, and it is, therefore, possible to operate the press with a fine adjustment and always at the highest rate which the character of the work will permit.

The diagram of the controller connections is shown in Fig. 5; a steel rod passing down from the handle at the left of the press feeder, Fig. 6, operates the contact arms by means of a bevel gear. These arms carry carbon brushes, and, passing over the segments, cut in or out armature resistance and series field windings. The contact arms are held in a semi-circular cast-iron connection which contains a series of small holes corresponding to the number of speeds secured by the controller. Pivoted at the center is a movable arm fitted with a handle and pin which can be made to enter any one of the ten holes. When the current is turned on and the controller revolved, this arm moves around until it engages a pawl operated by an electromagnet. As long as the current is passing through the motor this magnet holds the controller in position, but it will release the arm as soon as the current is interrupted, and a strong spiral spring on the controller rod immediately brings the arm back to the "off" point. The "automatic" device is thus secured, while the locking feature is obtained by means of the movable arm, which can be set at any hole corresponding to any desired speed. The hole corresponding to the normal speed is marked and the press is usually operated on this point.

On the right of the feeder is placed a small panel board containing the main line switch, a circuit breaker and fuses for protecting the motor. The switch is of the "tumbler" type and is connected so that when thrown up it connects the motor ready for operation. When this switch is opened an extension of each blade makes a contact with the lower clips so as to short-circuit the shunt fields of the motor through a non-inductive resistance, providing a path for the field discharge and thus avoiding the danger of a puncture. The circuit breaker is adjustable through a wide range, and is of the "time limit" type. In this type the acting magnet is shunted by an exposed coil of high-resistance wire. If an excessive current exists for a short length of time, the shunted current flowing through this exposed coil heats the wire and thus sends a larger proportion of the current through the magnet windings and the circuit breaker acts. Momentary currents, such as occur upon starting the motor, or when it is loaded heavily for an instant, are not supposed to open the circuit breaker. Unfortunately, the feeder soon discovers that the circuit breaker can be adjusted to such a point that it will bother him by operating only at long intervals, and at this point he leaves it. Practically, then, the motor must be

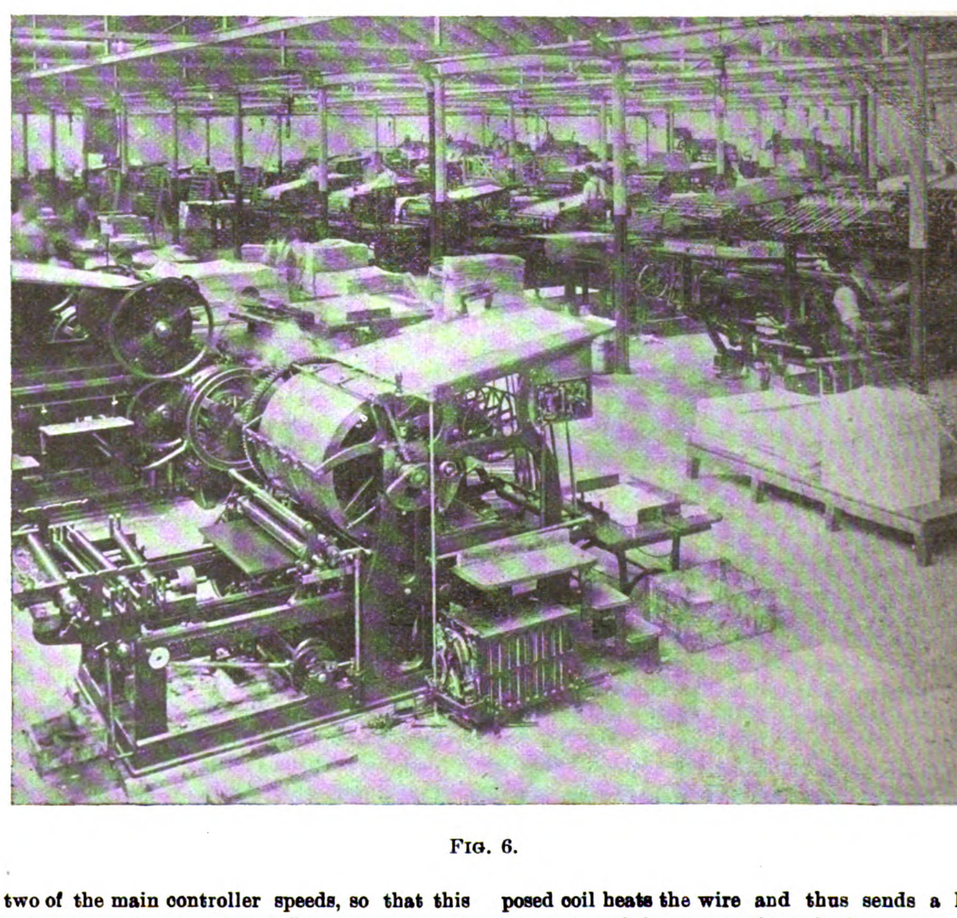

FIG. 6.

protected by fuses, which cannot be adjusted. These fuses are of the inclosed cartridge type and are placed in both sides of the circuit, one being located on either side of the main-line switch upon the panel board. The appearance of the controller and panel board can be seen on the press in the foreground of Fig. 6.

By means of a lever and arm which passes through the bottom part of the press the controller can be operated from the opposite side and the press can be run slowly in either direction in "making ready," without tugging at a belt or without the assistance of the feeder. Push-buttons are located at convenient places about the press frames, with circuits connected so as to shunt the "automatic" magnet attachment, and thus the press can be quickly stopped from any one of a number of points in case of accident.

It is needless to point out that such a model printing establishment as has been described would have been impossible with the old method of transmitting power by means of belts and shafting. The successful operation of this plant is such an emphatic argument in favor of the electrical method of operation that it may be well worth while to review briefly the advantages which have been secured.

The light throughout the plant is entirely unobstructed by belts, so that during the day full benefit is secured of the ideal skylight method of lighting, while at night the operators are not annoyed by shadows, and the amount of artificial illumination required is a minimum.

The predominating idea in the arrangement of the entire plant has been to secure convenience in operation, and the designers of the plant have not been hampered with the necessity of concentrating the machinery near the source of power or of arranging it, in all cases, convenient to long lines of shafting.

The elimination of overhead power-transmitting devices not only takes away the danger of moving belts and revolving pulleys but improves the appearance of the plant, and this is certainly appreciated by the employes, who take pride in the neat appearance of their work rooms.

Without overhead belts and pulleys keeping the dust-laden atmosphere in constant agitation, there is much less waste of stock spoiled by dripping oil or falling dirt—an advantage which it takes a printer to appreciate thoroughly.

The arrangement of the plant over a large area instead of in floors one above another, with belts passing from floor to floor, secures lower insurance rates. The wires running from the engine room to the departments, when once installed, require no further attention. One department may be operated overtime while the remainder of the plant is at rest. The lighter the load the more efficient become the transmitting circuits, while the opposite is true with belts and pulleys. The number of units in operation in the engine room can be varied to suit the changing demand for power, and thus secure an economy which is impossible with one large engine belted to a main driving shaft.

The absolute control of the presses, with their easy and convenient manipulation, when "making ready," and their wide range of speed, allowing them to be run at their fullest capacity, has a great influence in increasing the output of the plant. When a machine is not in operation it is immediately shut down, and there are therefore no "stand by" losses outside of the engine room.

The most important advantage, however, is the saving in fuel. The result of the operation of the new plant is that only about one-third of the amount of coal is burned that was required before the move was made. A part of this saving must be attributed to the design of the power plant, with its modern equipment, so that just how much economy has been gained by the operation of the purely electrical part of the plant cannot be definitely determined.

The Corliss engine was furnished by the Atlas Engine Company; the motors by the Sprague Electric Company; the motor controllers and starting boxes by the Cutler-Hammer Manufacturing Company, and the switchboard and wiring by the Western Electric Company. George C. Nimmons was the architect of the building, Bion J. Arnold consulting electrical and mechanical engineer, and Thomas Sheehan mechanical superintendent. Much of the success of the enterprise is due to the energetic management of the president of the company, W. B. Conkey.

RESEARCHES ON HIGH TEMPERATURES AND THEIR PRACTICAL EMPLOYMENT.*

An important paper has recently been published by Goldschmidt in the *Zeitschrift für Elecktrochemie*, in which he reviews previous works on the use of aluminum in producing high temperatures, and then describes the method he adopts. As is well known, an extremely violent reaction takes place when aluminum unites with oxygen, the estimated temperature of the reaction being about 3,000° C. In order practically to make use of the high temperatures thus obtained, the chief difficulty is so to moderate and control the reaction that it will perform the required work.

The first point to be noted is that it is not necessary to heat up the whole of the reacting mass to the temperature of ignition. It is sufficient to start the combustion at a single point only, but this in itself presents some difficulties. In the preparation of metallic chromium from a mixture of its oxide with powdered aluminum, these difficulties may easily be overcome by applying at any convenient point a small quantity of a mixture of aluminum with a more easily reducible oxide, or preferably a peroxide. Lead oxide, copper oxide, potassium permanganate, and many other substances may be employed for this purpose.

One great advantage of this process is that it admits of the preparation of pure metals free from aluminum; the only precaution which requires to be observed is that the oxide to be reduced must be present in slight excess.

The process is capable of two main applications. In the first place the heat given off by the combustion of a mixture of aluminum with any convenient oxide may be utilized for heating purposes only (welding, etc.), or, secondly, the reducing power of aluminum at a high temperature may be used for the preparation of pure metals or alloys. In either case only slight alterations in the mode of working are necessary. If a moderate heat be required, the reacting mass is diluted by the addition of some inert substance, which, at the same time, prevents the whole mass from melting. A convenient mixture of this sort is composed of aluminum and the cheapest available oxide (*e.g.*, iron ore, sand, etc.), which is then diluted either with a large excess of the same oxide, or with magnesia, lime, etc. If, on the other hand, the metal itself be required, a large excess of the oxide must be avoided, so that the heat which is generated will not only melt the metal, but also the slag (corundum), which then protects the regulus from the action of the air.

The following experiments illustrate the applications of the process: A rivet weighing 3 kilos., such as is used in the construction of bridges, is surrounded by a mixture of oxide of iron, sand, etc., and powdered aluminum, and almost wholly embedded in sand contained in a wooden box. On the top of the small exposed portion of the aluminum mixture is laid a small ball prepared by mixing aluminum powder with a more easily reducible oxide, and into which is inserted a short length of magnesium ribbon. The reaction is started by setting fire to the magnesium ribbon, and as soon as this is done, more sand is placed on the top in order to keep in the heat. If the contents of the wooden box are emptied out after a short time, it will be found that the rivet is white hot and ready for forging.

In a similar way 1 inch iron pipes may be hard soldered at an estimated cost of about 2d.; or, two pieces of wrought iron may be fused (welded) together. The joint so obtained is satisfactory, as can be shown by sawing the pieces through at the joint. It is claimed that such a joint is better than that produced by electric welding, owing to the greater uniformity of heat. By diminishing the quantity of inert material, the iron in the above experiment may be easily melted. Holes may be made through one-half inch wrought-iron plates by igniting some of the reacting mixture on them, and adding more, if necessary, as soon as the reaction has started.

In order to reduce chromium from its oxide, a mixture of this and powdered aluminum is made and introduced into a crucible lined with magnesia. The reaction is started as before, and the mixture then added continuously until the crucible is full. After cooling, the crucible is broken open and the regulus of metallic chromium removed. At the meeting of the German Electro-chemical Society, at which the author communicated his paper, he showed a mass of chromium, weighing 25 kilos., prepared in this way. By making two apertures in the crucible, one for the introduction of the mixture and the other for the outflow of the chromium, the process may be worked continuously, as in the case of the electric furnace.

It is claimed that the temperature attained is higher than in the ordinary electric furnace, and that a given quantity of material can be put through in a shorter time. Moreover, the chromium is also free from carbon or carbides. The slag (alumina) produced in the furnace may be reconverted into aluminum and used over and over again, or it may be used for polishing, since it possesses certain advantages over emery.

Almost all metals may be reduced from their oxides in this way, and the yield is nearly theoretical. The different alloys, *e.g.*, "chrom-manganin," copper-chromium, etc., can also be prepared. The slag from the furnace contains minute rubies, which owe their color to chromium.

For the preparation of pure metals, it is necessary to use pure aluminum; but for heating purposes only, crude (50 per cent.) aluminum may be employed. Besides oxides the oxy-salts of certain metals may be reduced in the same way.

The author looks upon aluminum as a "*heat accumulator*," since it is possible to transport it, and by its union with oxygen develop, wherever necessary, an amount of energy corresponding to that which was originally required for its preparation.

The above is an abstract of an article which may be consulted in the *Zeitschrift für Elektrochemie*, iv., (21), 494.

*From the *Electrical Review*, London.

Lamp Holders for Meterless Consumers.

In some districts in England small consumers whose quarterly bills for electrical energy could not support the burden of a meter rental are charged a fixed price per lamp per annum. The charge can take account of the possibility of exceedingly long burning-hours, but not of the honesty-factor of the consumers, the temptation to put in lamps of higher candle-power than those contracted for being very great. At Kingston, we believe, this difficulty was overcome by using locked holders, but a French firm of manufacturers has found a neater solution. The lamp-caps and holders are made on the bayonet principle, but with three pins and slots instead of two. These are placed in different relative positions for lamps of various candle-powers, so that only the lamp of the right size will fit the holder supplied for it.

ERRATUM.—In our issue of November 2, in the middle of the first editorial column, $1 per thousand should have read $1.50 per thousand.

AN ELECTRICAL SURVEY IN THE BOROUGH OF MANHATTAN, NEW YORK CITY.*

Showing Results of Stray Current Measurements Between Electric Railways, Underground Pipes, Etc, Also Results of Tests on the Brooklyn Bridge.

BY A. A. KNUDSON.

(Concluded from page 262.)

Coming now to the tests, it will be noticed that there is no possibility of reaching the anchor plates other than by connection through the cables themselves, and they being firmly attached to the structure cables make all practically one conductor, and a connection on the structure would mean connection with the cables and consequently with the anchor-plates.

This point therefore being settled, the next thing was to obtain a suitable ground, and on the suggestion of Mr. C. B. Martin, the electrician of the bridge, one of the railway cables was used during that portion of the day when it was not in operation for hauling a bridge train. This was a convenient as well as a good ground; the cable surface being polished bright through friction in passing over the pulleys, it was possible to obtain a good contact, and as it passed over the large drums in the engine room, which were on foundations connecting with engines, water-pipes, etc., it was probably the best ground independent of the structure obtainable. The connection to the structure was made by the use of a two-inch screw-clamp, the wire to the voltmeter being attached to it by the simple means of a screw and washer. Two of these clamps were generally used in nearly all of the previous tests, as they were found very convenient for attaching and detaching quickly to and from hydrants, pillars, etc. The first test under these conditions was made just over the Brooklyn anchorage, where the structure was found to be positive to the ground, with a difference of potential of 2¾ volts maximum, estimated average 1¾ volts.

At the Brooklyn tower another ground connection was made to a water-pipe which ran down the side of the tower and is intended for use in case of fire on the bridge. At this point the reading was 3¾ volts maximum, average 2¾; bridge structure was as before positive. At center of span, structure positive at first, with 2¼ volts maximum, but during the readings there were two reversals, one of them only remaining long enough to obtain a reading, which was 1¼ volts maximum, structure negative. At the New York tower: structure positive to cable ground, with trolley variations ranging from three-fourths to 8 volts, average 2 volts. At New York anchorage: maximum 2¾ volts, average 2 volts, structure positive to ground.

Other tests were made to determine the polarity of the rails of the bridge trains, and they were found positive to the structure, the same as the rails of the trolley road heretofore tested. Let us now consider the question of electrolytical conditions of the cable anchorages, as this point appears to be of high importance in this matter, if not the key to the whole situation in determining whether or not electrolytic action is going on. First—These anchorages are composed of solid stone masonry and are put together with the highest quality of cement; there is no brickwork or mortar in their construction.

Second—The 23 tons of iron composing the plates are set about 80 feet below the top of the anchorage. The distance from the bottom of the plates to mean high water is 3 feet 8 inches at the New York end, 5 feet at the Brooklyn end; there is no earthy matter, salts or alkalis, such as is found prevalent in the streets, which go to make up an electrolyte, so I am informed, in any part of this structure.

I was at first apprehensive that on account of the comparatively short distance between mean high water and the plates at both anchorages there might be opportunity for salt water to reach the plates through seepage or capillary attraction and thereby produce such an electrolyte as to cause corrosion, but have been informed that it is not possible for salt water to reach these terminal plates on account of the distance from the river, the anchorages being over 900 feet from the towers which stand at each side of the river. Even allowing 100 feet for the salt water to work back, there is still ample margin as to distance before salt water can reach these plates; besides this, one of the bridge engineers showed me a plan of the construction of the foundation under each anchorage which consists of heavy timbers 10″ x 10″ and some 12″ x 12″ arranged in 4 to 7 layers, placed a short distance apart, and the intervening spaces filled in with concrete cement.

In view of the tests therefore that have been made showing the structure and cables to be positive at both ends, it is quite possible that a portion of the current straying from the trolley lines, and possibly from the bridge service, finds its way out of the anchor plates through the dampness of the stonework of these anchorages. The construction of these anchorages however is such, as I have endeavored to set forth, that it seems reasonable from the general construction of these piers that the mass of stone and concrete surrounding these plates will not constitute an electrolyte such as would favor electrolysis and thereby cause corrosive action on them.

One of the bridge officials informed me that a certain authority had reported that electrolysis would not attack cast-iron, consequently their cast-iron anchor-plates were exempt from such danger. In the light of recent experience in other cities, that theory is now untenable; for instance I will quote a few extracts from a pamphlet, giving the reports of four experts, besides that of the secretary of the Water Board of the city of Dayton, O., embodying an estimate of cost for repairing the damage.

Mr. E. E. Brownell, C. E., states: "To my surprise I have found in this city a six-inch water main that was corroded to the depth of one-quarter of an inch where the voltage did not average over 1.5 to 2 volts positive to the rails, therefore it is impossible to establish a certain voltage that will cover all cases for low readings."

The following extracts are quoted from the report of Mr. J. H. Shaffer, metallurgist.

He says: "In accordance with instructions from the Board, I have made a careful inspection of the cast-iron water mains at fifteen different locations in the city," and then gives the results of excavations, etc., two of which I will quote:

"1st. This excavation was made at the corner of Washington and Mound streets. It exposed a six-inch main and a ten-inch tee; the pipe was laid in 1874, and the tee in 1888, both were subjected to electrolytic action for about ten years. Both pipe and tee showed great evidence of electrolytic corrosion, the pipe being damaged to an alarming degree, with holes pitted from one-eighth to five-sixteenths of an inch in depth, and covering a large portion of the same. . . The lead caulking was found to be in bad condition, and showed perceptible evidence of leaking. The pipes at this point were nine volts positive to the rails.

"2d. This excavation was made on Germantown street, near Krug. It uncovered a six-inch pipe. This pipe was electrolytically corroded in about the same proportion, with other conditions identical. A lead service pipe was also exposed at this point, and was found to be entirely destroyed."

A quotation from the report of the secretary on an approximate estimate of the cost of replacing water-pipes damaged by electrolysis caused by electric railway currents may also be interesting.

He says: "In calculating the cost of replacing the pipes in the whole affected territory, it is estimated at $77,208.80.

"There is 17,513 feet of pipe that shows a voltage of from two to nine volts positive, and from pieces of pipe removed where electrically charged to this extent, it is found that they have deteriorated 50 per cent. in four years.

"Where they were required, when laid, to withstand a hydrostatic pressure of over 300 pounds per square inch, when tested by J. H. Shaffer, iron expert, after being subjected to 4.5 volts for four years, leaked at 150 pounds pressure."

He also states the following: "At 4.5 volts it has been shown that a six inch pipe can certainly become useless in 5 years."

I have quoted thus freely from this pamphlet for two reasons, one to show that it is a mistake to suppose that cast-iron is not subject to corrosion by electrolysis produced by railway currents, and also to show the penalty to which a city is subjected through permitting such conditions to exist so long that they cause such heavy damages to its property. In the light, therefore, of what has been shown to be the state of affairs in the upper part of this city due to escaping railway currents, as well as the experience at Dayton, O., it appears to be the duty of engineers to exercise every possible precaution against the effects of this invisible element of destruction, which if left to itself will certainly shorten the life of valuable city property.

In the cases found to exist up town it is true that the rails of the road referred to are apparently the principal metals damaged, for the reason that they happen to be positive to the water pipes, but as the escaping current goes into the pipes at one place it must come out at others, and at these places damage may be looked for.

The damages already done and threatened to public works in England by electrolysis has led to the establishment of regulations to prevent such action in the future, and similar legislation may be expected in this country should these conditions be allowed to continue. One of the provisions in the regulations prescribed by the British Board of Trade may be of interest just here. It is to the effect that if the pipe is negative to the rails the potential difference shall not exceed 4.5 volts, and if the pipe is positive to the rails the potential difference shall not exceed 1.5 volts. This appears to be very liberal for the railways, in view of the experience in cities on this side of the water; it is probable however they will be made more stringent as future experience in this direction dictates.

I have purposely avoided elaborating any particular scheme for preventing damage by stray railway currents in this paper, for the reason that methods are perfectly well known to railway companies for confining currents to their proper conductors, such as efficient bonding, and providing a return that will leave no inducement for the current to seek underground pipes in preference to a legitimate conductor. It is simply a question of additional expense. Referring to the incandescent light current which was found prevailing everywhere in this part of the city from the Harlem river to the Battery, passing between all kinds of underground metals, and some on the surface, I do not consider these currents as particularly dangerous at the moment on account of their low voltage, but as before stated, it having been established that a fraction of a volt difference of potential will cause electrolytic action, it then comes down simply to a question of time, when those straying incandescent currents will have to be seriously considered.

In conclusion, I wish to say that these remarks regarding possible damage to public structures through the action of electrolysis have been made with no desire on my part to appear as an alarmist, but to present simple facts as found in these investigations. I believe that too little attention has here-

* A paper read at the 128th Meeting of the American Institute of Electrical Engineers, New York, October 26th, 1898.

tofore been paid to this matter by any of us; perhaps for the reason that electrolytic action being invisible as well as noiseless, it has thus escaped attention, and its baneful effects not fully appreciated. It is my opinion, however, that ordinary caution would suggest that periodical tests should be made in every city by competent parties where a trolley road using a ground return is in operation, and the reports placed before those having authority to deal with the matter. In this way threatened damage by electrolysis to water and other pipes, as well as bridges, might be arrested and finally controlled.

Mountain Railways.

An electric railway is in successful operation in California which is novel in many features.

The initiation and successful construction of such a railway connecting the sea shore with the summits, the pine with the rose, the orange with the snowball, are due to Prof. T. S. C. Lowe, of Pasadena. With the exception of the electric road now in process of construction up the Jungfrau, there is probably no enterprise identical in scope and attractiveness, nor one where greater obstacles have been surmounted.

All the other systems of such mountain roads built for the purpose of making the natural attractions of a region available for the sightseer are constructed on the plan of a revolving cog wheel catching in a center rack-rail and operated by a steam locomotive. One of the roads lands one on top of a sulphurous caldron in the crest of Vesuvius; the Rigi, pioneer of its class in Europe, gives one a delightful glimpse of the mountain meadows of the land of William Tell and its hundreds of glacial lakes; the Pike's Peak rack-rail road lifts one up to an unparalleled view of a vast ocean of gray plains. But on the summits reached by the Mount Lowe Railway every one of the attractive landscape features of the others has been included. Below, seemingly within speaking distance, lies all the beauty of contour, the fragrance, as well as the productiveness, with which we are accustomed to associate the classic lands of the eastern half of the Mediterranean.

The cable incline, which constitutes the first division of this mountain road proper, is one of the most successful railroad devices of its kind in practical use in the world.

The electric power is transmitted by large copper conductors to the Echo Mountain power house, in which is a 100 horse-power electric motor which makes 800 revolutions per minute. By a series of gears the revolutions are reduced from 800 to 17 per minute, which is the speed at which the massive grip-sheave turns. The grip-sheave consists of a heavy wheel which carries some 70 automatic steel jaws. As the wheel revolves, these jaws close and grip an endless cable, to which the cars are permanently attached. By this method there is practically no wear whatever to the cable. It is not strained and chafed by the constant operation of gripping, as on the street railway cars, where the inertia of trains of cars of many tons weight has to be overcome by the gripping of the ever-moving cable.

So much for the incline division. From the end of this, i. e., starting from the Echo Mountain House, begins the overhead trolley road, which reaches the "Alpine Tavern" after a rapid and remarkable ascent by which the very heart of the range is penetrated, and over five miles of steep mountain grades are surmounted in the space of thirty-five minutes. The terminus of this alpine division connects with some thirty miles of most excellent bridle paths and carriage roads, leading in all directions over the crest and through the range.

A cable dispatch states that the newspapers of St. Petersburg, Russia, announce the expected visit to that city of Thomas A. Edison, the inventor, and say that the scientific societies are preparing to give him a brilliant reception.

LONDON NOTES.

[From our London Correspondent.]

In Memory of the Late Dr. Hopkinson.

In memory of her late husband, Mrs. Hopkinson, her son and daughter have presented the sum of £5,000 for the purpose of extending the engineering laboratories at Cambridge University. This was a work which the late Dr. Hopkinson took a special interest in, and only a few days before his death he was talking to Prof. Ewing of opening a subscription fund for the purpose.

Electric Traction for London.

The London County Council is giving earnest consideration to the question of electric traction. At the beginning of 1899 there will come under its control 70 or 80 miles of horse trams in London, therefore the fact that it is looking into the question of electric traction is important. The Council proposes allowing a tramway company to put up the trolley for about a couple of miles in one of the suburbs, and one of its own members, Mr. Baker, has issued by request a very elaborate report on electric tramway work generally. He compares the costs of various methods and ends by recommending the introduction of the underground conduit, in spite of the fact that its initial cost is considerably more than that of the trolley, because he says it is the one best suited to the requirements of London's busy thoroughfares. Mr. Baker also considers gas, oil, steam, cable and other forms of traction. He tells the Council that for horse traction they will have, when they take over the lines, to pay from 50 per cent. to 100 per cent. more than by the electric system for maintenance and working. It is probable that there may be some decided move shortly in this matter. The Council is to have a debate on the entire subject in a day or two.

CANADIAN NOTES.

The statement of the Montreal Electric Street Railway for the last year shows the net profits to have been $601,704.18, against $507,885.60 for the year previous. After paying a 10 per cent. dividend $138,000 was carried over to the rest account.

The new fender which will be used on the cars of the Ottawa Electric Street Railway was successfully tested this week. The new fender is an ingenious invention of the Consolidated Fender Company of Providence, R. I., and all the cars will shortly be equipped with them at a cost of over $5,000, or about $80 per car. The fender is about six inches from the rail and is so constructed that by the motorman touching a spring the appliance immediately drops and picks up the object in front of it.

For the past two weeks there has been an experiment going on in Ottawa which has now developed into an industry. It is the manufacture of calcium carbide for the production of acetylene gas by means of a new yet simple and effective method. The inventors of this new scheme are Messrs. H. Lamoth and J. W. McRae of Ottawa. The new idea is in the furnaces which are to be used in the manufacture of the carbide. The ingredients used are coke and limestone, the two being mixed in proper proportion and thoroughly purified. The furnace to be used is a simple construction and is heated by electricity. The furnace consists of two electrodes, one suspended from above and the other placed on the ground. The two are connected by means of carbon pencils which form an arc producing sufficient heat to melt the coke and limestone which is piled around these electrodes, and form it into calcium carbide. It is the intention of the promoters of this new industry to erect a plant containing about 40 of these furnaces which will be kept running 16 hours per day. The carbide is produced for $60 per ton wholesale and the factories now making this product throughout Canada are unable to keep up with the orders now flowing into them. By operating their present plant the inventors expect shortly to be able to turn out about 10 tons of carbide per day.

LEGAL NOTES.

John M. Sellers and E. A. Noonan have filed a petition in St. Louis for a receiver and an accounting for the St. Louis Underground Service Company and the Citizens' Electric Light & Power Company. The petitioners charge the officers with conspiracy to defraud the stockholders. A reorganization of both companies is requested.

In the third trial of the Jessie Krueger damage suit against the West Chicago Street Railway Company, at Chicago on the 28th ult., Judge Hutchinson discharged the jury, who were unable to come to an agreement, and a fourth trial will probably result. Miss Krueger asked for $75,000 damages. She was run over by a car of the West Chicago Street Railway line on June 27, 1892, and received injuries which necessitated the amputation of her left leg. The case was first brought to trial in 1896 and the jury awarded the plaintiff $50,000. The Appellate Court ordered a new trial, which was begun last February. It was abandoned because of the death of a juror. The third trial resulted as above stated.

A Customs Decision.

The Board of Classification of the United States General Appraisers have announced a decision regarding the tariff on incandescent electric lamps. The Collector at New York assessed a duty of 60 per cent. ad valorem, under paragraph 100, Act of 1897, which covers various articles of glass, or of which glass is the material of chief value, and blown glassware. A protest was filed by the importers, Knauth, Nachod & Kuhne. The board holds that while glass is the component material of chief value, yet the other materials, carbon filament, porcelain, metal and cement, are so essential to the character of the lamp that it ceases to be merely blown glassware. The board holds further that the goods are covered by paragraph 112, which includes manufactures of which glass is the component material of chief value, not specially provided for. The protest is sustained and the duty fixed at 45 per cent.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING.

Baldwin, Wis.—Peabody & Sabby have formed a copartnership to put in an electric lighting system here.

Birmingham, Ala.—Three electric light plants will be erected at Pratt City and Ensley. One of the plants is to supply light and power for Pratt City; the others are smaller plants, one at the Ensley City steel plant and one at the Semet-Solvay by-product works.

Camden, N. J.—An ordinance has been introduced in the city council giving the Citizens' Heat, Light & Power Company the right to string wires and erect poles in the streets.

Columbus, Wis.—Local business men and capitalists are contemplating putting in an electric light plant upon such terms that the city will at the expiration of twenty years become the owner of the plant.

Dolgeville, N. Y.—The Dolgeville Electric Light & Power Company of Dolgeville has filed a certificate with the Secretary of State announcing that its number of directors has been decreased from thirteen to five.

Grand Rapids, Mich.—Manager Chase of the Chase Construction Company is in the city making preparations for beginning work on the contract for installing the municipal electric lighting plant. He expects to employ about 100 men.

Green Bay, Wis.—It is stated that negotiations for the sale of the plant of the Green Bay Gas & Electric Light Company have been closed. The A. M. Sutherland Company of New York, Sinclair Mainland of this city, and William Mainland of Oshkosh are the principal investors. The purchase price is withheld. Bonds to the amount of $125,000 have been subscribed for and $50,000 will be spent in improvements.

Hagerstown, Md.—The town council has taken the initial movement looking to the establishment in Hagerstown of an electric lighting plant. The town is empowered to borrow $60,000 for an electric plant. The mayor will appoint a committee of citizens to report on the subject.

Johnstown, Pa.—The city authorities have closed a five-year contract for street lighting with the Johnstown Electric Company, calling for 204 arc lights of 2,000 candle power each. Under the new contract the city saves $2.50 on each light from the price formerly paid.

Lancaster, Pa.—The select and common councils have passed an ordinance approving of the assignment of the city lighting contract held by Gustavus Groezinger and associates to the Lancaster Electric Light, Heat and Power Company. The company has filed its acceptance of the ordinance. It has also executed a mortgage for $100,000, the proceeds to be applied to increasing the capacity of the plant.

Malone, N. Y.—The trustees have granted a franchise to Messrs. Kilburn, Wright and Abbott authorizing them to set poles and string wires in the village for the purpose of conducting an electric lighting and power business.

Odessa, Mo.—A stock company is to be organized here to put in a $5,000 electric light plant.

Perrysville, O.—E. H. Vanderslice proposes to use the water power that formerly ran the Perrysville flouring mill to operate an electric plant for lighting purposes. He has secured contracts for over 100 incandescent lights and expects to get 300.

The Dalles, Ore.—Mayor Nolan has vetoed the ordinance providing for lighting the city streets by means of electricity. Among the reasons given by the mayor is the important one that the finances of the city do not justify the council in making the contract.

Winona, Miss.—A company has been organized here to put in an electric lighting plant if the city votes to take street lights. The company is composed of local business men and will establish a first-class plant.

STREET RAILWAYS.

Albany, N. Y.—The board of trustees of the village of Ravenna have lately visited this city for the purpose of interesting capitalists in the proposed electric railway from Albany to Ravenna. The project to build a road through the villages of Ravenna, Coeymans, Indian Fields, South Westerlo, Preston Hollow, Clarksville and Rensselaerville has been under advisement for some time, but it has been decided to make the attempt on a larger scale than before contemplated. It is proposed to make it a freight carrying concern.

Atlanta, Ga.—The Atlanta Railway Company has been granted the franchises for streets on the west side which it asked for and will prove a formidable competitor of the Consolidated Street Railway Company. The latter company had practically a monopoly of the street car business in Atlanta.

Boston, Mass.—The Boston & Maine Railroad Company has decided to equip its Portsmouth & Dover branch, about ten miles in length, for electrical operation, the power to be furnished from a power house on Noble's Island, which will also supply power for the Portsmouth, Newcastle & Rye Electric Street Railway.

Dayton, O.—The surveys for the Dayton, Spring Valley & Wilmington interurban electric road are being made, and in a few days work on the construction of the power house will begin.

Camden, N. J.—An ordinance has been introduced in the city council giving a number of Philadelphia capitalists the right to erect and operate an elevated electric railway in Camden as part of a system connecting with Atlantic City.

Chicago.—The Calumet Electric Street Railway Company has installed two passenger elevators at its new terminal station at the corner of 63d street and Stony Island avenue. The elevators are capable of hoisting passengers to the station platform, 32 feet above, at the rate of 100 a minute.

Cumberland, Md.—The county commissioners will be asked at their next meeting for their consent to the projected route for an electric railway between Cumberland and Westernport. As soon as this is granted the survey will be made.

East Liverpool, O.—A syndicate of New York, Chicago and Philadelphia capitalists will build an electric freight line between this city and Lisbon, connecting the Erie system with the Ohio river. The road will pass through the richest undeveloped coal field in Ohio, and the syndicate has secured options on 18,000 acres of coal land. The new road and the mining plant will represent an investment of $700,000.

Exeter, N. H.—Superintendent E. E. McReel of the Exeter-Hampton Street Railway states that work on the extension of the road to the New Hampshire State line will be pushed in order to have the cars running if possible by December 10 over that section. About five and a half miles of track is to be laid.

Geneseo, N. Y.—There is talk of a stock company being formed to build an electric road from Mt. Morris and Geneseo to Conesus lake.

Hartford, Conn.—The "Times" says it is reported that an agreement has been reached between Jesse W. Starr and George H. Dunham, the rival street railway promoters and petitioners for franchises in West Springfield and Agawam, under which the Dunham petitions were withdrawn and both men will do their utmost to secure the franchises petitioned for by the Starr company.

Jersey City, N. J.—Mayor Hoos has signed the ordinance granting the North Hudson Railway Company permission to operate the cars on the Grove street line, connecting Jersey City with Hoboken, with electricity instead of horse power. The franchise is perpetual, and the company agrees to pay the city $600 a year.

Lansdale, Pa.—The Inland Traction Company, whose object is to build a trolley line from Perkasie to Lansdale, has received a charter.

Lincoln, Ill.—The Lincoln Electric Light & Street Railway Company has been granted a forty years' extension of its franchise.

London, Eng.—Albert Johnson, brother of Tom Johnson, the Ohio trolley magnate, has arrived here and is holding consultations with electricians and capitalists concerning the project of introducing electric roads in London and other English cities. London has now an underground electric road, but there is a demand for surface roads extending to outlying districts. Mr. Johnson says there is no city in the world that offers such advantages for the establishment of the American trolley system. A company is already formed to promote electric roads in the city, with a capital of £1,000,000 sterling, and if the necessary street privileges are obtained from the city council, electric surface lines will speedily be built in several sections of the city.

Marysville, O.—M. A. Wright, of Maple Dell, representing a company of wealthy capitalists, has applied to the county commissioners for right of way for an electric railway connecting Richwood, Pharisburg and Magnetic Springs with Marysville.

Merrill, Wis.—The Merrill Electric Railway & Light Company has decided to rebuild its electric plant and will begin the work at once.

Milford, Mass.—A party of Worcester, Westboro and Milford capitalists have associated together for the purpose of building an electric railway from Milford to Westboro via Hayden Rowe and Hopkinton, and have formed a corporation known as the Westboro, Hopkinton & Milford Street Railway Company. The capital stock of the company is $80,000, and the length of the road is 8 miles. William S. Reed of Leominster, Joseph G. Ray of Franklin, Edgar K. Ray of Franklin, M. H. Walker of Westboro, Charles B. Tewksbury of Westboro, Frank W. Wood of Hopkinton and Horace Wood of Hopkinton are the temporary directors.

Montpelier, Vt.—A bill has been introduced in the House to incorporate the Swanton Electric Railroad Company which proposes to build and operate roads in the towns of Franklin and Highgate. The capital stock is placed at $100,000 with power to increase. The incorporators named are H. M. Stone, C. C. Gilmore, H. A. Burt, F. J. Hawley, W. C. Butterfield, C. H. Reynolds, L. H. Felton and C. G. Austin.

Mt. Vernon, N. Y.—The council has awarded a franchise to the Westchester Electric Railway Company, some of the conditions of which are that the company shall carry passengers from Mt. Vernon to the Harlem River for 5 cents, run cars under a five minute headway, and pay 3 per cent. of its gross receipts into the town's treasury. The franchise is to run fifty years and requires that the company give a bond for $25,000 for the carrying out of the agreement.

New York.—In the November number of the "Street Railway Journal," President H. H. Vreeland of the Metropolitan Street Railway Company has an article in which he compares the operating costs of the various systems. He says: "For the year the operating expenses of the cable lines were 16.42 cents per car mile, of the horse lines 17.87 cents, and of the electric lines 10.23 cents. For the three months period, which is more favorable to electric operation, the cable lines cost 17.55 cents, the horse 17.89 cents, and the electric 10.06 cents. During the twelve months period the cable lines operated at 47.7 per cent. of their passenger receipts, the electric lines at 37.9 per cent., the horse lines at 65.3 per cent., and the entire system at 53.3 per cent. During the three months period the cable lines operated at 52.7 per cent. of their passenger receipts, the electric lines at 38.6 per cent., the horse lines at 62.1 per cent., and the entire system at 50.9 per cent."—The Third Avenue Railway Company has a large number of men at work excavating along its Third avenue line for the change in motive power from cable to underground trolley. It is expected that the new system will be ready within four months.

Norwalk, O.—It is authoritatively stated that a new electric road will soon be built between this city and Sandusky. Clark Rude of Sandusky and W. W. Graham of Norwalk are taking an active interest in the scheme and are said to have secured plenty of Eastern capital for the enterprise.

Oswego, N. Y.—Receiver Frederick H. Tidman of the Lake Ontario & Riverside Railway Company has announced that the street car service of the company will be discontinued until further notice. The road has been running behind at the rate of $100 a week. Some betterments are to be made on the road, which are expected to greatly increase the patronage.

Owosso, Mich.—The projectors of the electric railway between Pontiac and Owosso agree to have cars running by the 1st of January. The line will be an extension of the Detroit & Pontiac road.

Portland, Ind.—The Albany, Dunkirk & Camden Traction Company and the Camden, Dunkirk & Albany Traction Company, rival lines for the purpose of constructing a road between Camden and Albany, passing through the city of Dunkirk, have consolidated their interests, and the general expectation now is that the work will be hurriedly pushed.

Redlands, Cal.—Henry Fisher, J. H. Fisher and O. H. Childs have purchased a controlling interest in the Redlands Street Railway with intent to change the motive power of the road to electricity. Bonds to the amount of $50,000, bearing interest at 6 per cent., will be issued for the purpose.

St. Louis.—The Lindell Railroad bill passed by the city council has been approved by the mayor.

Washington, D. C.—The amount of street railway trackage operated by the various companies in this city is as follows: Capital Traction, 16 miles; Metropolitan, 12 miles; City and Suburban, 25 miles; Columbia, 2.86 miles; Brightwood, 5 miles; Washington and Great Falls, 3½ miles. This includes single and double track.

MANUFACTURING, ETC.

New Haven, Conn.—It is reported that as a result of the recent purchase of the Walker interests by the Westinghouse Company, the local branch of the Walker Electric Company will be removed at once to Pittsburg.

New York.—The report in press dispatches from Chicago that the Siemens & Halske Company of America were considering a proposition from the Japanese Government to form a Chicago syndicate with a capitalization of $10,000,000 to establish electric street car lines and electric plants for lighting and power throughout the empire, is doubted by the Japanese Consul in this city, who is reported in the "Commercial" as saying: "I doubt if there is the slightest truth in the report. The Japanese Government has not the power to grant such a franchise. It may be possible that there is an effort being made to secure American electrical appliances by private individuals in Japan; but as for granting exclusive privileges to American electric companies, I do not credit it." In the dispatch referred to it was stated that Messrs. Elkins and Widener of Philadelphia would be included in the syndicate, but they have since asserted that they had absolutely no knowledge of the matter and that no such step was contemplated by them.

Paris, France.—Commissioner Peck has been officially notified that 5,000 additional feet of space had been allotted to the United States at the Exposition, making a total of 40,000 feet additional to the original concession.

Washington, D. C.—The "Times" states that J. E. Powell, who will have charge of the electrical display of the American exhibit at the Paris Exposition, and who has just returned to Washington from Paris, is enthusiastic over the proposed representation of the United States at the Exposition.

TRANSMISSION PLANTS.

Denver, Col.—The Board of Aldermen has granted a franchise to the Denver Power & Irrigation Company to erect poles, string wires and build conduits for the purpose of transmitting electricity into Denver for light, power and heat from its proposed transmission plant to be erected at the head of Platte canon. Rhodes Bros., Equitable Building, Denver, are the promoters of the enterprise.—Theodore F. Van Wagenen, a mining engineer of this State, is stated in the "Republican" to have completed one of the most extensive plans for electric power for placer mining in the West. The plant is located in the Boise basin of Idaho, and is to supply power for placer mining to two companies organized by the Basic Company of Philadelphia—the Bed Rock Dredging Company at Placerville and the Boise Dredging Company at Centerville. The power plant was constructed under the superintendence of Mr. Van Wagenen.

Santa Fe, N. M.—An electrical generating plant is to be built at Cochite to run by water power, and all the mines in the surrounding country will, it is expected, be supplied with power from the plant.

Seattle, Wash.—The "Post Intelligence" of the 23d ult.: says: "The Sunset Falls Power Company is already preparing to create a use for the electric power to be generated at Sunset and Eagle Falls on the Skykomish river. It has sent a party of engineers to survey a line for an electric railroad from Index up the north fork of the Skykomish to Galena. It is proposed to follow the south bank of the north fork as far as Trout creek, then to cross by means of a bridge and run along the north bank for the rest of the distance."

COMPANY MATTERS.

Albany, N. Y.—A certificate of the voluntary dissolution of the Compressed Air Power Company of New York City, was filed on the 29th ult. with the Secretary of State. This was a Metropolitan Street Railway corporation, which was organized when the question of using compressed air as a motive power on the system of the Metropolitan Traction Company in New York was being discussed, but it dissolved owing to the determination to install the underground electric trolley system on the street surface railway lines of the Metropolitan Company.

Brooklyn, N. Y.—Internal Revenue Collector Moore of this city has received a decision from the Washington authorities to the effect that the Edison Electric Illuminating Company of Brooklyn must pay a revenue

tax of $5,000 on a mortgage of $10,000,000 recently executed by the company to secure a like amount of bonds which the stockholders had agreed to issue. When the mortgage was executed the Edison Company submitted the documents to Collector Moore for an opinion as to the amount of tax the company would have to pay under the War Revenue act. As only $2,000,000 of the bonds are to be issued at present the company believed that it was liable to a tax upon that amount only. Commissioner Scott, however, holds that the instrument is subject to taxation as a mortgage for $10,000,000.

Norfolk, Va.—Judge Waddill of the U. S. Court has appointed B. Watkins Leigh receiver of the Portsmouth & Port Norfolk Electric Railway Company. The action was taken on the application of the Mercantile Trust & Deposit Co. of Baltimore, trustee under a mortgage given by the company, and M. E. Decker, of New Jersey, who furnished supplies. The receivership was a surprise to people here, as the sale of the line to a company of wealthy Northern men was momentarily expected.

NOTES FROM A CORRESPONDENT.

Albany, N. Y.—Open competitive civil service merit examinations for positions in the State service will be held Dec. 3 in the following cities: Albany, Amsterdam, Auburn, Binghamton, Buffalo, Dunkirk, Elmira, Geneva, Hornellsville, Ithaca, Jamestown, Kingston, Little Falls, Lockport, Malone, Middletown, Newburg, New York, Ogdensburg, Olean, Oneonta, Oswego, Plattsburg, Poughkeepsie, Rochester, Rome, Sandy Hill, Schenectady, Syracuse, Utica and Watertown. Among the positions for which examination is held are that of chief electrical engineer and assistant electrical engineer.

Schenectady, N. Y.—Complaint has been made for some time past that wire and other material has been stolen from the General Electric Works. The police has succeeded in arresting a man who was carting away about a ton of copper wire which was identified as belonging to them by the General Electric Company. The thief refused to tell the names of his accomplices.

PERSONAL AND MISCELLANEA.

The Cincinnati "Post" says that letters have been received from Col. H. P. Bradford, now in Mexico City, Mex., formerly general manager of the Main street car line in Cincinnati. Mr. Bradford is now general manager of the Mexican Consolidated Street Railway Company, and is converting the system from a mule service into an electric line.

The Portsmouth, O., "Times," in stating that the contract for electrically equipping the Burgess mill in that place was awarded to the Westinghouse Company, says that "Mr. Hodge, the clever little representative of the Westinghouse people, was greatly elated over his success, and that night took his rivals for the contract—the representatives of the General Electric Company and the Triumph Company—to the Opera House to see 'A Stranger in New York.'" Hodge evidently has good stuff in him.

The new power house of the Hagerstown, Md., Electric Railroad Company has been singularly unfortunate. During its construction, which has been going on for several months, the walls when near completion have been twice thrown down by storms, and a few days ago the last of the iron roof trusses was being placed in position when it swayed and fell, displacing the other girders, all going down in a mass, crushing out the newly erected walls, and leaving the structure a heap of ruins for the third time. Several of the workmen were injured on the last occasion and two of them will probably die.

The New York correspondent of the Philadelphia "Press" refers to Mr. Nikola Tesla's wireless aerial transmission discovery in a dubious spirit. After calling attention to the fact that several of Mr. Tesla's most boldly announced devices have failed to materialize after publication, he goes on to say: "There have been promises made in his name for wireless telegraphy, but Marconi seems to have achieved where Tesla only promised. This last invention of his comes well within the description made by Lord Kelvin when he was here a year ago of the improbable possibilities of electric development. Lord Kelvin said that there were two peculiar tendencies on the part of those who were carried away by the romance and fascination which electricity furnishes, one being to make prediction of probable impossibilities and the other to make prediction of improbable possibilities. Scientists here and capitalists as well look upon Tesla's promise to convey electricity of enormous voltage through the upper air to convenient stations as being of the class described by Lord Kelvin as improbable possibilities."

E. L. Anderson of St. Louis, the electro-chemist of the Phoenix Carbon Company, has, it is stated, made a discovery "that will startle the electrical world." It is claimed that he has discovered a process of manufacturing and conducting electricity without the aid of dynamos, engines, or any of the ordinary apparatus. The "Star" says he has succeeded in interesting several parties of good financial standing in his invention and has applied for a patent. "The process as far as can be learned," the same paper says, "consists of a jar of water, into which is put a chemical that has the power of drawing a certain oxygen out of the air. The solution of the air and water produces the electricity. These jars are placed beneath the seats of cars or vehicles, in the basements of buildings and residences, and are connected by means of wires. It is only necessary to refill the jars once a month with water."

RECENT COMPANY ELECTIONS.

Chattanooga Electric Railway Company, Chattanooga, Tenn.—President and treasurer, J. H. Warner; vice-president and secretary, Edwin Warner; directors: J. H. Warner, Edwin Warner, Capt. Charles A. Lyerly and Frank Spurlock, of Chattanooga; Percy Warner, of Nashville, and G. W. Meade, of Brooklyn, N. Y.

East Wareham, Onset Bay & Point Independence Street Railway Company, Onset Bay, Mass.—President, Joseph K. Nye of Fairhaven; secretary and treasurer, Anderson W. Kelley of Fairhaven; directors: Fred L. Benson of Onset Bay, Capt. Benjamin F. Gibbs of East Wareham, and William F. Nye of Fairhaven.

Exeter Street Railway Company, Exeter, N. H.—President, William Lee; treasurer, Charles E. Hollander; clerk, John Templeton; directors: Charles A. Cotton, W. D. Lovell, Charles E. Hollander, William Lee and R. E. Hastings, all of Boston; Warren Brown of Hampton Falls, and A. E. McReel of Exeter.

Joliet Street Railway Company, Joliet, Ill.—President, Weston F. Milliken; vice-president, George T. Duncan; treasurer, Henry P. Cox; secretary, Henry Woodman, all from Portland, Me.; manager, William B. McKinley, Chicago; superintendent, C. O. Rush, Joliet.

Thomson-Houston Electric Light Company, Quincy, Ill.—President, Frederick Wilms; vice-president, Capt William Steinwedell; secretary and treasurer, Frank A. Parker; superintendent, W. E. Steinwedell; directors: the officers and H. F. J. Ricker, J. M. Haynes, Col. William McKinley and L. E. Emmons.

Wilkes-Barre Electric Light Company, Wilkes-Barre, Pa.—President, Abram Nesbitt; vice-president, J. W. Hollenback; secretary and treasurer, E. W. Mulligan; directors: the officers and John Flanagan, Liddon Flick, W. P. Billings, E. H. Jones, Charles W. Lee, W. A. Lathrop, E. C. Jones and Irving A. Stearns.

Winchester Avenue Street Railroad Company, West Haven, Conn.—President, W. B. Furgeson; vice-president and secretary, I. A. Kelsey; treasurer, John F. Prince; superintendent and general manager, Albert E. Pond.

COMMERCIAL PARAGRAPHS.

The Lombard Water Wheel Governor Company, 61 Hampshire street, Boston, Mass., has recently issued an attractive catalogue descriptive of its well-known water-wheel governors. The work is fully illustrated by half-tones showing various plants in which the Lombard water-wheel governors have been installed. The last few pages of the catalogue are devoted to testimonial letters, all speaking very highly of the excellent regulation in speed obtained by the use of the Lombard governor.

The Consolidated Incandescent Light Company of 510 West 53d street, New York—operating and controlling the Apollo Incandescent Gas Light Co., the Victor Incandescent Co., the Star Incandescent Gas Light Co., and the Ideal Lamp Co.—have on hand at all times a large and select assortment of Apollo and Ideal burners, Apollo and Victor mantles, and glass shades and chimneys of all descriptions. The prices at which these goods are sold are extremely low considering the quality, and any one interested can secure, free of charge, a monthly price sheet by sending name and address to the company.

We are in receipt of catalogue No. 4, just gotten out for 1899 by Messrs. Huebel & Manger, 286-290 Graham street, Brooklyn, manufacturers of electrical and brass goods. This pamphlet of 50 pages is very attractive in appearance and fully illustrated. The above parties have at all times on hand a large and select assortment of electric bells and buzzers, push buttons of every description and design, binding posts, switches, speaking tubes and letter boxes. Judging from the catalogue the prices are moreover reasonable.

One of the greatest problems which present themselves to every electric light station manager is the proper protection of electrical machinery from damage by lightning. Anything leading to a proper solution of the problem is always welcome. The Electric Appliance Company of Chicago have just issued a special circular of Wurts Lightning Arresters which embodies all of the improvements to date in this class of apparatus and gives some valuable hints with reference to protection from lightning.

Three very handsome and fully illustrated catalogues have been sent us by the C. W. Hunt Company of Staten Island and 45 Broadway, New York. The first of these discusses very fully the advantages to be derived by the introduction of industrial railways in manufacturing establishments and illustrates apparatus of this nature manufactured by this well known concern. This little work is so well gotten up and contains so much valuable information that it should be in the hands of all those interested in the conveying question. The second catalogue is entitled "Mast Fittings, Coal Tubs, Hoisting Blocks, Wheelbarrows," and each of these subjects is taken up, discussed, and the high grade of apparatus manufactured for these purposes by the Hunt Company illustrated. The third catalogue, on the subject of "Manila Rope for Transmission and Hoisting," is even more complete than the two catalogues mentioned above, containing as it does formulas, tables and general data of value in mill engineering. This little work, comprising 40 pages of valuable information, should certainly be in the hands of all engineers in any way interested in power transmission for factories or mills.

The accompanying illustration shows the latest type of Edison Jr. incandescent lamp, which would seem to be rapidly growing in favor judging from the large number of orders the company is reported to be receiving. That this lamp has a long life and maintains its initial candle

power is now an established fact. At the recent Peace Jubilee in Philadelphia several thousands of these lamps were made use of for decorative purposes, giving general satisfaction. How well the Edison Jr. lamp is getting to be thought of may be gathered from the following communication:

Tuxedo Club, Tuxedo Park, N. Y., Oct. 3, 1898.
Thomas A. Edison, Jr., 27 William street, New York.

Dear Sir: Please pardon my long delay in acknowledging the receipt of your letter of May 26, and the three 16 CP., 105 volt, Edison base, Edison Jr. improved lamps.

Have had the three sample lamps in continuous service since receipt; have shown them on the banquet tables, in octagonal pyramids of ice. "Oh, how beautiful!" I can say they have won for you our trade.

In a few days I will have the Club order sent for our supply of lamps.

Please write me, do you pack 200 or 250 in bbl. lots.

Yours truly, E. I. WILBUR.

During the past summer the Joseph Dixon Crucible Company of Jersey City, N. J., have added an extension to their pencil factory, 40 by 90 ft., three stories high. The same is driven by electric power from a generator placed in the main factory. No expense has been spared in the equipment of this addition in the way of up-to-date elevators, furnaces, dry-rooms, etc. The company will also put down an artesian well, several hundred feet in depth, for a supply of water for factory use, and some time during 1899 various other additions will be built to the Dixon Company's very extensive plant. The Dixon Company was established in 1827, but during all of its more than threescore years and ten of busy life, no year has yet in any way equaled 1898 for volume of business; its plant has been running continuously, yet the company is behind its orders in all departments. As the Dixon Company's products go into every known field of industry—the iron workers, the brass workers, the printing trades, the stationers, the cycle manufacturers, the hat manufacturers, the paper mills, etc.—the rise or fall of the volume of business done by the Dixon Company may be taken as a very excellent standard or pointer on the condition of business generally.

INVENTORS.—We neither purchase nor sell your patent, but we examine and report on it to you. If it has merit we furnish endorsements of experts that commend it to capitalists—and those who can use it. Correspondence solicited. Fees moderate. Address

EXPERT, care ELECTRICITY.

INCORPORATIONS.

The Waterbury Battery Company, Waterbury, Conn. Capital stock, $10,000. Incorporators: C. Platt, Charles B. Schaumacht and O. M. Platt.

The International Fac-Similigraph Company, Cleveland, O.—to manufacture devices for electrical transmission of photographs. Capital stock, $25,000.

The Joplin Illuminating Company, Joplin, Mo. Capital stock, $80,000. Incorporators: John C. Porter, Harrison J. Dunham, Francis Kuhn and Charles Nelson.

The Camden, Dunkirk & Albany Traction Company, Camden, Ind. Capital stock, $150,000. Incorporators: G. W. and J. A. Simpson of Chicago, and George W. Whittaker of Dunkirk.

The Montezuma & Oglethorpe Light Company, Montezuma, Ga.—to operate electric and other lighting plant. Capital stock, $3 000. Incorporators: Jule Felton, V. O. Brown and S. K. Brown.

The Albany, Dunkirk & Camden Traction Company, Albany, Ind. Capital stock, $25,000. Incorporators: H. Clay Billingsley, John E. Billingsley, W. F. Machlan and G. L. Sullivan.

The Cincinnati, Lawrenceburg & Aurora Electric Street Railway Company, Aurora, Ind. Capital stock, $10,000. Directors: J. C. Hooven, George H Helvey, G. A. Reutchler, C. E. Hooven and Fred H. Shafor.

The Sands Electric Company, Cleveland, O.—to manufacture all kinds of electrical appliances. Capital stock, $10,000. Incorporators: L. Sands, Edward Velhagen, F. B. Skeels, C. R. Hunt and O. A. Bejck.

The Abbott Electric & Manufacturing Company, Cleveland, O.—to manufacture electrical and mechanical devices. Incorporators: H. H. Hammond, H. I. Wickes, William A. Marbach, Samuel Abbott and C. B. Abbott.

The South McAlester Electric Light Company, Fort Smith, Ark. Capital stock, $25,000, of which $5 000 is paid in. Incorporators: L. G. Graham, J. T. Miller, W. J. Wade, Joseph R. Foltz and W. P. Andrus of Fort Smith.

The Edison Junior Electric Light & Power Company, New York. Capital stock, $500,000. Incorporators: Thos. A. Edison, Jr., S. R. Valentine Robinson, H. C. Hepburn, E. A. Drake, C. S. Henry, R. M. Jordan, J. G. Batterson, Jr., and F. J. Stone.

The Citizens' Light, Heat & Power Company, Camden, N. J.—to manufacture electricity for light, heat and power. Capital stock, $100,000. Incorporators: Andrew S. Scull and Joachim R. Moon of Camden, and Wesley Bartine of Philadelphia, Pa.

Three charters were recently recorded in the office of the recorder of deeds at Media, Pa. They were for the Darby-Lansdowne Electric Company, the Clifton-Lansdowne Company and the Yeadon-Lansdowne Company. These companies are formed for the purpose of furnishing heat, light and power to the various boroughs. Those interested are: T. P. Street, H. C. Statzell, M. J. Kelly, J. M. Lutz, R. Shoemaker, E. T. Bishop, N. J. Mitchell and E. R. Lewis.

ELECTRICAL PATENT RECORD.

Letters Patent Issued November 1, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

613,301. Yoke for Railway-Conduits. Fred S. Pearson, Boston, Mass. Filed Nov. 4, 1897.

613,357. Suspension for Electric Railway-Motors. William Cooper, Cincinnati, O., assignor to John B. Blood and Joshua Hale, Newburyport, Mass. Filed Aug. 16, 1898.

613,418. Electric Railroad. Charles L. Kemery, Pittsburg, Pa. Filed Jan. 12, 1898.

613,483. Electric-Railway System. Louis E. Walkins, Springfield, Mass., assignor of one half to George M. Jewett, Glenville, Md. Filed Nov. 18, 1897.

613,825. Car-Fender. John Sexton, Los Angeles, Cal. Filed May 27, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

613,248. Incandescent-Electric-Lamp Holder. George W. Cook, Jr., Bloomfield, N. J. Filed Nov. 5, 1897.

613,293. Mechanism for Supporting Electric-Arc Lamps. William A. McCallum, Avondale, Ohio. Filed Nov. 18, 1895.

613,406. Electric Car-Lighting William Biddle, New York City, assignor to the American Railway Electric Light Company, same place. Filed May 14, 1894.

613,647. Insulator for Incandescent Electric Lamps. Charles W. Brown, Boston, Mass., assignor, by mesne assignments, of one-half to Laroy S. Starrett, Athol, Mass. Filed Dec. 15, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

613,848. Printing-Telegraph. Aloys Wirsching, New York City. Filed May 10, 1897.

613,533. Telephone Box or Cabinet. Ishmael Sparks, Santa Fe, N. Mex. Filed March 22, 1898.

SIGNALS AND SIGNALING APPARATUS.

613,549. Grade-Crossing Signal for Railways. Harry M. Abernethy, Elmira, N. Y., assignor to the Eclipse Switch & Signal Company, Camden, N. J. Filed Sept. 9, 1897.

613,567. Block-Signaling Apparatus. Taylor T. Fogel, Allentown, Pa. Filed Dec. 6, 1897.

MISCELLANEOUS.

613,286. Emergency Fusible Cut-Out for Electric Circuits. Charles H. Long, Louisville, Ky. Filed July 10, 1897.

613,309. Electric Ignition Device for Internal-Combustion Engines. Louis W. Ravenez, Paris, France, assignor to the Societe Nouvelle des Etablissements, Decanville Aine, same place. Filed March 7, 1898.

613,367. Electric Rotary Cutter. Fulton Gardner, Chicago, Ill. Filed March 19, 1897. Renewed Jan. 24, 1898.

613,420. Electric Vehicle. Karsten Knudson, Chicago, Ill., assignor to the American Electric Vehicle Company, same place. Filed June 18, 1897. Renewed Sept. 21, 1898.

613,594. Electrical Fuse-Wire Holder. William D. Packard, Warren, Ohio. Filed Sept. 29, 1897.

TELEPHONE AND TELEGRAPH.

The San Francisco *Report* in its issue of the 24th ult. says: "The four great telephone and telegraph systems of this coast will henceforth be known as the Pacific States Telephone Company. These companies are the Oregon Telephone & Telegraph Company, with lines covering the greater part of Oregon; the Inland Telephone & Telegraph Company, taking in Eastern Oregon and Washington; the Pacific Telephone & Telegraph Company, comprising the lines in the city and county of San Francisco; the Sunset Telephone & Telegraph Company, whose lines cover nearly all of California, the lower portion of Oregon and Eastern Washington. These four companies are under practically the same ownership and have the same officers and boards of directors, so far as the State laws under which they operate will permit. The new name has been adopted for the sake of convenience."

The city council of New Orleans has granted the People's Telephone Company permission to go ahead with the work of constructing its underground conductors. Vice-president Curtiss of the People's Company states that the work will be pushed as fast as money and labor can do it. He promises to give the people of New Orleans a first-class, up-to-date telephone system, as thorough and complete as any in the United States. He says: "Every telephone that we put in will be on the metallic circuit and prepared for long distance connections, and even the residence 'phones will have two wires, or, in other words, a wire going and returning, all to themselves. We will put but one subscriber on a line, because we do not believe we can give good service by putting three or four on a line, and what we want to do above all things is to give perfect service."

The Hon. John Roche, a member of the British Parliament, who is at present in Ottawa, expresses the opinion that by January 1 next the land telegraph line will be finished between Dawson City and Skaguay, and as soon as possible afterwards the latter place will be connected by cable with Vancouver. Mr. Roche represents a number of English capitalists who have acquired the charter granted by the Dominion Parliament last session to a company to build this line from the coast to Dawson by way of the Yukon and its affluents. The plan is to construct a double land line from Skaguay to Lake Tagish and Fort Selkirk to the Klondike, following the present mounted-police route, so that the police posts may be used as telegraph stations. Work is to be begun immediately.

The Grand Rapids, Mich., *Herald* of the 26th ult. says: "In the case of the Western Electric Company against the Citizens' Telephone Company and others, which was decided some time ago in the United States Circuit Court in favor of the defendants, proceedings have been perfected for an appeal to the United States Court of Appeals for the Sixth Circuit. The suit was based on alleged infringements of a device for making connections and calling customers to telephones by the insertion and rotation of a 'crank shaft' or 'spring jack' in the switchboard at the central station. The device is alleged to be covered by the Gilliland patent, which contention the telephone company disputed successfully in the lower court."

A Circuit Court jury in Kansas City decided recently that W. J. Meeker of Caney, Kan., was not libeled when, in 1895, J. W. Jordan of Cross, Ok., sent him a telegram saying: "Your sweet lies give you the advantage of me. Use it if you like and show who you are robbing. Pay your own messages." Meeker waited two years after the sending of the telegram and then went to Kansas City and sued the Western Union Telegraph Company for $2,000 damages to his reputation. The company proved that nobody could have known of the telegram aside from Meeker, Jordan and three operators.

The South Texas construction office of the Bell Telephone Company, located at Houston, has a great deal of work on hand at present. In a few days it will begin the construction of a new 111-mile toll line, leading from Corpus Christi to Victoria. The former place has so far been isolated from the telephone world. Complete plans have been made for a line from Texarkana through to Houston via Palestine, but these have yet to be approved by the company.

A delegation from the Merchants & Manufacturers' Board of Trade, New York, last week held a conference with representatives of the New York Telephone Company in regard to a reduction in rates. On behalf of the board the delegation asked that the company give to subscribers the rate of $50 for 1,000 calls or less, and five cents each for all calls above that number. The company's reply had not reached the board at its meeting on the 3d inst.

General A. W. Greely, Chief Signal Officer, says that up to the present time the work of improving the telegraph service in Porto Rico has been restricted to lines that were a military necessity. Offices in which only civil business is taken have been left to the last. In many of the offices the Spanish operators remain, in order that there may be no congestion of business through the ignorance of Spanish customs and language of the American operators. About one hundred men of the Signal Corps are now employed in this service, and with the introduction of American customs it is believed the number will be materially increased.

A project is on foot by G. M. Van Ausdall, J. E. Peterson and E. H. Stephenson of New London, Ia., and J. W. Gregg of Lowell, Ia., to place the two towns in communication by telephone. The enterprise will be organized immediately and the work of erecting the line will be pushed at once. The Lowell people have indicated their desire for such a service by purchasing a liberal supply of tickets which entitle them to the use of the line for a limited time. The public will be charged a reasonable fee for the telephone.

The Empire State Telephone Company has abandoned several of its lines in Ontario county, N. Y., and taken out the instruments from its offices in Bristol, Bristol Center, East Bloomfield, West Bloomfield, Bristol Springs, Naples, Honeoye, Reed Corners, Rushville, Miller's Corners, Middlesex and Vine Valley. This action was taken to avoid litigation with certain farm owners along the roads through which the company's poles are erected and wires strung, who were induced by a Batavia lawyer to sue the company for damages at the rate of $6 a pole.

The Washington *Star* states that Lieut. Col. Robert Craig, Signal Corps, United States Army, has been ordered to proceed to Santiago de Cuba and thence to Guantanamo, Baracoa and other points, in order to examine and report fully upon the extent and condition of the telegraph lines in the department of Santiago, the availability of timber supplies in the country for the reconstruction and other essential points connected with the reconstruction of such lines as are necessary for military purposes.

Honolulu, the capital of Hawaii, is a city numbering 30,000 inhabitants, and is lighted with electric light; it has a complete telephone system. The islands of Oahu, Kauai and Hawaii have telephones to every accessible point. The rent of an instrument is moderate, and a small charge for service is made for those who do not or can not afford to possess an instrument of their own. On the Island of Maui the telephone system is as yet incomplete.

The People's Telephone Company of Detroit, Mich., has declared a dividend of 10 per cent. In the last year the entire line was equipped with a metallic circuit. The company's lines are now connected with Wayne, Romulus, New Boston, Willow, Waltz, Carleton, Flat Rock, Rockwood and South Rockwood.

The York Telephone Company and the Pennsylvania Telephone Company are both endeavoring to get a foothold in Dover, Pa., but there is a company already in operation there, composed of local people, which opposes the entrance of either of the others into the town, and consequently Dover has become a center of telephone agitation.

The American Bell Telephone Company's instrument statement for the month ended October 20 shows: Gross output, 33,639; returned, 11,823; net output, 21,816. In the same month last year the gross output was 23,181; returned, 7,145; net output, 15,986. The total output October 20 was 1,077,402.

The Minnesota Central Telephone Company has extended its line into St. Paul and opened a station in that city for the convenience of the public. The lines connect with Ortonville, Appleton, Brown's Valley, Elbow Lake and the intermediate points on the lines on which these towns are located.

A telephone line from Sparta, Tenn., to Crossville is now assured. Manager J. N. Cox of the Gainesboro Telephone Company has let the contract for line material and the poles and wires will be erected in a short time.

At Norton, Kan., an automatic telephone system is being put in, and will be ready for operation by the middle of the month. About 75 'phones have been subscribed for.

In the recent fire at Tuskegee, Ala., the telephone exchange was among the thirteen business places totally destroyed.

New Company Incorporated.

The Fowler Switchboard & Telephone Company, New York—to manufacture telephone and other electrical fixtures. Capital stock, $5,000. Incorporators: John F. McKay, Samuel B. Fowler and Victor Heckles.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc, income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Nov 7:						
Albany Ry. Co	100	2,000,000	$1,750,000	1¼ % Q., Aug. '98.	151	158
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug., 98.	[illegible]	67
Traction Co. (Saratoga)	100	50,000	50,000	......	..	..
Allentown, Pa.—Nov 7:						
Allentown & Lehigh Val. Trac. Co		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Nov 7:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Nov 7:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98	73	..
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	25½	25⅝
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	...	..
Boston, Mass.—Nov 7:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97	13¼	13¾
North Shore Traction Co com.	100	4,000,000	1,000,000		10	13
North Shore Traction Co pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	76	79
b West End Street Ry. Co com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	..	83
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	103	...
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	73½	74
Brooklyn N. Y.—Nov 7:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	215	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	66¾	67
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	225½	227
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000		..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	230	..
Kings County Elevated	....	4,750,000	4,750,000	....	5	8¾
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad pfd.	......	6,000,000	6,000,000	....	70	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo. N. Y.—Nov 7:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	62	66
*Buffalo Railway Co	100	6,000,000	5,370,500	1 % Q. Dec., '97.	78	78¼
Columbus O.—Nov 7:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Aug., '98.	51½	55½
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Nov 7:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '98.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Nov 7:						
Chicago City Ry. Co	100	12,000,000	12,000,000	8 % Q.	295	299
Chicago & South Side R. T. RR.	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR.	100	10,000,000	10,000,000	....	13¼	13½
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	....	..	3
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Oct., 98.	228	230
hNorth Chicago City RR.	100	500,000	219,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Oct. 98	93	93¼
jChicago West Div. Ry guar.	....	1,250,000	621,900	35 %	..	..
kChicago Passenger Ry guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Nov 7:						
Cincinnati Inc. Plane Ry com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	29¾	30
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118⅛	118¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Nov 7:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¼ % Jan., '98	39	41
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	73	75
Cleveland Electric Ry	100	12,000,000	12,000,000	¼ % Q., Oct., '98	79	80
Detroit, Mich.—Nov 7:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100⅛	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Nov 7:						
City Railway Co com.	100	1,500,000	1,470,600	1¼ % Q., Jan 1,'98.	105	..
City Railway Co pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	103

*Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Nov 7:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	—
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	—
Holyoke Mass.—Nov 7.						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	185	200
Hoboken, N. J.—Nov 7:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	103	—
Indianapolis, Ind—Nov 7.						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	24	25
Lancaster, Pa.—Nov 7:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	—
Lancaster & Col. Electric Ry	....	....	87,500	....	..	—
West End Street Railway	....	....	....	....	..	—
Louisville, Ky.—Nov 7:						
Louisville Ry com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	39	40
Louisville Ry pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98	102	102½
Minneapolis, Minn.—Nov 7:						
Twin City Rapid Transit com.	100	17,000,000	15,010,000		27	29
Twin City Rapid Transit 7 % pfd.	....	3,000,000	1,714,200	1¾ % Jan., '98.	101	103
Montreal, Canada.—Nov 7:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	278	278¼
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¼ % S., J. & J.	105¾	105⅞
Memphis, Tenn.—Nov 7:						
Memphis Street Railway Co	100	500,000	500,000	....	15	—
New Haven, Conn.—Nov 7:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	..
New Orleans, La.—Nov 7:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	151	200
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co com.	100	5,000,000	5,000,000	....	7½	8⅛
New Orleans Traction Co pfd.	100	2,500,000	2,500,000	....	9	11
aCrescent City RR guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	6¼	32
bNew Or. City & Lake RR guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23½	25
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	117½	122¼
New York—Nov 7:						
Central Crosstown RR	100	600,000	600,000	2½ % Q	255	..
cChristopher & 10th Sts. RR guar.	100	650,000	650,000	2 % Q., July, '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., '98	140	150
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¾ % Q., Oct., '98	166¼	166⅝
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	1½ % A., July, '98.	34	37
fBroadway & Seventh Ave guar.	100	2,100,000	2,100,000	2½ % Q.	216½	25
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	180	185
hEighth Avenue RR	100	1,000,000	1,000,000	......	60	...
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	370
jNinth Avenue RR guar.	100	800,000	800,000	....	180	..
kSixth Avenue RR guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co guar.	100	600,000	600,000	4½ % Q.	3[illegible]0	370
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	178	180
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. '98.	1[illegible]2	1[illegible]3
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	70¼	71
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	190
Newark N. J.—Nov 7.						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	50¾	51⅜
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	.
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Nov 7:						
Allegheny Traction Co	50	500,000	500,000	....	49	50
oConsolidated Traction Co com	50	15,000,000	15,000,000	2 %, Jan., '95.	2[illegible]	20⅜
Consolidated Traction Co pfd.	50	15,000,000	15,000,000	3 %, May, '97.	5[illegible]	56⅛
pCentral Traction Co	50	1,500,000	‖900,000	....		...
qCitizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	64½	...
rDuquesne Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	8 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	24⅞	25
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	‖2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	½ %, Jan., '96.	25	23¼
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897, thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value o stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.–Nov 7;						
Union Street Railway Co..........	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton.Mass–Nov 7:						
Northampton Street Ry..	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.–Nov 7:						
Omaha Street Ry.............. ..	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.–Nov 7:						
Paterson Ry. Co................	100	1,250,000	1,250,000	....	54	..
Providence, R. I.–Nov 7:						
United Traction & Electric Co	100	8,000,000	8,000,000	¼ %, Jan. '98.	68	70
Philadelphia.–Nov 7:						
Fairmount Park Trans. Co...$20 pd	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‡1,966,100	2½ %, July 15, '98.	40	..
Hest'nvi'e, Man. & Fairm't..6 % pfd	50	533,900	‡533,900	3 % S—July, '98	67	..
*a*Fairmount Pk. & Had. Pass. Ry	50	300,000	300,000	3 % Feb. 1, '98.	66	..
Union Traction Co......... $12½ pd	50	30,000,000	29,930,450	....	20	20⅛
*c*Electric Traction Co............	50	....	8,297,920	....		...
*d*Citizens' Passenger Ry........	50	500,000	†192,500	$3 share Q.	320	..
*e*Frankford & Southwark Pas. R	50	....	‡1,875,000	$14 sha'e A—Apr.98	400	..
*f*Lehigh Avenue Ry. Co.........	50	1,000,000	....	....	48	...
*f*Lombard & South Street Ry...	25	....	1,000,000	A. & O.	89	90½
*d*Second & Third Streets Ry...	50	1,060,000	†771,076	$9 share A, Mar. 98	265	...
*e*People's Traction Co..........	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
*g*Germantown Passenger Ry...	50	1,500,000	‡572,800	$5.25 share—1898.	134½	136
*g*Green & Coates Passenger Ry.	50	500,000	‡150,000	3 % Jan., 1898.	135	..
*h*People's Passenger Ry....com	25	1,500,000	‡710,000	....	...	...
*h*People's Passenger Ry....pfd.	..	750,000	‡277,402	....	...	...
*i*Philadelphia Traction Co........	50	30,000,000	‡20,000,000	$2 p. sh., Oct. 98.	9.7⅛	92
*j*Catherine & Bainbridge St.....	50	....	‡400,000	6 % A—Mar., '98.	...	..
*j*Continental Pass. Ry.....guar..	50	1,000,000	‡580,000	$6 share—July, '98.	140	145
*j*Empire Passenger Ry. Co......	50	600,000	‡600,000	....	...	..
*j*Philadelphia City Pass. Ry.....	50	1,000,000	‡475,000	$7.50 share July '98	170	180
*j*Philadelphia & Gray's Fy. RR..	50	1,000,000	298,650	$3.50 share July '98,	90	..
*j*Ridge Avenue Passenger Ry....	50	750,000	‡420,000	$12 share, July '98.	285	300
*j*Philadelphia & Darby Ry.guar.	50	....	‡200,000	$2 share July, '98.	...	..
*j*17th & 19th Sts. Pass. Ry. guar...	50	....	‡250,000	1½ % S., July, '98.	157½	..
*j*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‡835,000	$11 sh. A., July, '98	2.0	..
*j*Union Passenger Ry. Co........	50	1,500,000	‡900,000	$9.50 shre, July '98	220	..
*j*West Philadelphia Pass. Ry....	50	750,000	‡750,000	$10 share, July '98	225	250
Rochester, N. Y.–Nov 7:						
Rochester Railway Co.............	100	5,000,000	5,000,000	....	15	19
Reading, Pa.–Nov 7.						
*j*Reading Traction Co..................	..	1,000,000	1,000,000	Semi-an.,Jan. & Jy	18	20
*k*City Passenger Ry.....................	50	350,000	350,000	Jan., '98.	114	...
*l*East Reading Electric Ry...........	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.–Nov 7:						
Fourth Street & Arsenal Ry........	50	300,000	150,000	....	..	..
Jefferson Avenue Ry. Co...........	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry................................	100	2,500,000	2,400,000	1¼ % Oct.,'98.	139	140
National Railway Co.................	..	2,500,000	2,479,000	1½ %, Oct.,'98.	..	----
Cass Avenue & Fair Grounds....	..	2,500,000	2,500,000	....	..	..
Citizens' RR..............................	100	2,000,000	1,500,000	1 %, Oct., '98.	90	110
St. Louis RR.............................	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR.............................	50	2,400,000	2,300,000	1½ % Oct , '98.	170	175
People's RR. Co......................	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry............com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	114	116
St. Louis & Suburban Ry............	100	2,500,000	2,500,000	....	51	52
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.–Oct.						
California St. Cable RR...............	100	1,000,000	600,000	50c. monthly.	108	109
Geary Street Park & Ocean RR......	100	1,000,000	375,000	$2.50 share, '96.	45	50
Market Street Ry......................	100	18,750,000	18,750,000	Q., 60c. per share.	53¾	54
Presidio & Ferries RR.................	100	1,000,000	550,000	....	8½	..
Scranton, Pa –Nov 7:						
Scranton Railway Co...................	50	6,000,000	2,500,000	....	12	15
*m*Scranton & Carbondale Trac. Co..	100	500,000	500,000	....	14	18
*m*Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	..	..
Springfield Ill.–Nov 7:						
Springfield Consolidated Ry	100	750,000	750,000	....	----	..
Springfield O.–Nov 7:						
Springfield Street Ry.....................	100	1,000,000	1,000,000	....	..	..
Springfield, Mass.–Nov 7:						
Springfield Street Ry..................	100	1,200,000	1,166,700	8 % A.	200	205
Toronto Canada.–Nov 7:						
Toronto Ry. Co........................	100	6,000,000	6,000,000	1¾ % S.	103¾	103⅞
Montreal Street Railway Co.........	......	4,000,000	4,000,000	4 % S.	278	278½
Washington, D. C.–Nov 7:						
Belt Ry. Co..............................	50	500,000	500,000	....	..	..
Capital Traction Co.....................	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	78¾	79
Columbia Ry. Co.......................	50	400,000	400,000	6 % A.	65	75
Eckington & Soldiers' Home Ry....	50	707,000	652,000	....	11	..
Georgetown & Tenallytown Ry....	50	200,000	200,000	....	...	..
Metropolitan RR. Co.................	50	1,000,000	453,900	2½ % Q.	126	127
Worcester, Mass.–Nov 7:						
*Worcester Traction Co.........com.	100	3,000,000	3,000,000	....	12	18
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	97	98
Worcester & Suburban Street Ry...	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.–Nov 7						
Wilkesbarre & Wyoming Val. Trac	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
f Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1878-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.–Nov 7:						
American Bell Telephone Co.......	100	50,000,000	28,650,000	4½ % Q., Oct., '98.	278	280
Erie Telegraph & Telephone Co....	100	......	......	1 % Q., Aug '98.	76	..
New England Telephone Co.........	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	138	..
New York.–Nov 7:						
American Telegraph & Cable Co...	100	14,000,000	14,000,000	1½ % Q	96½	98
*Central & South Am. Teleg. Co.....	100	6,500,000	6,500,000	1½ % Q.	108	110
*Commercial Cable Co...............	100	10,000,000	10,000,000	1¾ % Q.	180	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1½ % S.	40	50
Erie Telegraph & Telephone Co.....	100	5,000,000	4,800,000	1 % Q., Aug., '98.	76	..
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	..
*International Ocean Tel Co.guar6%	100	8,000,000	......	1½ % Q.	109	..
Mexican Telephone Co...............	100	2,000,000	......		..	80
*New York & New Jersey Tel. Co..	100	5,000,000	8,728,000	1½ % Q., July, '98.	151	153
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co.........	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	92	..
†Commercial Union Telegraph Co...	25	500,000	500,000	8 % S., July, '98.	110	118
Western Union Telegraph Co.......	..	......	97,870,000	1¼ %, Oct., '98.	92⅝	93
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.–Nov 7:						
American Dist. Teleg. (Phila.).....	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)...	100	8,168,000	8,168,000	2 % S.	171	178
Chesapeake & Potomac Telep. Co..	100	......	......	....	50	..
Chicago Telephone Co..............	100	......	......	......	235	240
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	132½	134
Empire & Bay States Telegraph Co.	...	......	......	....	72	78
Hudson River Telephone Co.......	100	2,000,000	2,000,000	1 % Q.	75	78
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	112	118
Providence (R. I.) Teleph. Co.......	50	....	......	....	89½	..
Southern New Eng. Teleph. Co.....	100	8,000,000	......	....	121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.–Nov 7:						
Fort Wayne Electric Co.............	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new]...... "	100	18,276,000	18,276,000	......	81	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2¾	5¼
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	38	81½
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	57½	58
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.–Nov 7:						
Edison Elec. Ill'g Co., New York..	100	9,188,000	7,988,000	....	142	147
*Edison Elec Ill'g Co., Brooklyn..	100	4,000,000	4,000,000	1½ % Oct., '98.	..	..
Edison Ore Milling Co.............	100	......	......	....	11	14
Edison Electric Storage Co.........	..	......	......	....	28	30
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug , 1898.	..	...
General Electric Co. [new].... "	100	18,276,000	18,276,000	......	81	81½
Interior Conduit & Insulation Co...	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.–Nov 7:						
Allegheny County Light Co........	100	500,000	500,000	J. & J.	130	140
East End Electric Light Co.........	50	800,000	800,000	Q	..	10
Philadelphia, Pa.–Nov 7:						
Edison Electric Light Co...........	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	4[illegible]¾	42
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	49¾	50¼
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co..	10	6,500,000	550,000	$32500 dis. Jan.11'97	13¾	14
Southern Elec. Light & Power Co..	10	187,500	187,500	....	16	..
Miscellaneous.–Nov 7:						
Brush Electric Co.....................	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co....	25	500,000	......	......	32	35
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	15
Eddy Electric Mfg. Co.............	25	......	......	....	----	15
Hartford (Conn.) Elec. Light Co....	100	850,000	......	....	125	..
Hartford (Conn.) Lt. & Power Co..	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co....	100	100,000	......	....	170	180
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	70½	..
Rhode Island Elec. Protec. Co	100	......	......	....	118½	125
Royal Elec. Co. (Montreal)..........	..	1,000,000	.....	2% Q	155	156
Toronto (Canada) Elec. Light Co...	100	1,085,000	1,085,000	1¾ % Q	136¾	136½
Thomson-Houston Welding Co......	100	......	......	8 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co.....	100	.....	.....		100	..

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827, 00 of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.–Nov 7:						
American Electric Heating Co.........	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1,'98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	92	100
New York.–Nov 7:						
Consolidated Electric Storage Co...	...	......	....	....	18	20
Edison European...........................	..	......	....	.....	1	8
Safety Car Heating & Lighting Co..	100	......	....	......	100	104
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	34	37
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	97	100
Philadelphia, Pa.–Nov 7:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	--
Electro Pneumatic Trans. Co.......	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	..	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	16	17
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	66	67
Welsbach Light Co..................	5	525,100	......	....	44	44½
Welsbach Light Co., Canada.	5	500,000	......	....	..	2½
Pittsburg, Pa.–Nov 7:						
Carborundum Mfg. Co...............	100	200,000	200,000	....	..	..
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q	117	118
Miscellaneous.–Nov 7:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	18	15
*Barney & Smith Car Co ....pfd.	100	......	2,500,000	2 %	...	55
Billings & Spencer Co...............	25	......	....	....	30	36
Consol. Car Heating Co.............	100	1,250,000	1,250,000	1½ % Feb. '98.	32	35½
Johns-Pratt Co.......................	100	......	....	....	90	100
*Pratt & Whitney Co..........com.	100	......	....	....	4	8
*Pratt & Whitney Co...........pfd	100	......	....	....	44	49
Stillwell-Bierce Co..............com.	..	......	....	....	..	...
Stillwell-Bierce Co...............pfd.	..	.....	......	2 % Sept. 1, '97.	..	90
Shults Belting Co....................	100	500,000	......	....	82	87
St. Charles Car Co..................	--	......	......	----	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Nov 7, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112⅛	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	375,000	1947	M. & N.	*111	....
‡Watervleit Turnpike & RR.1st mtg. 6s	850,000	350,000	1919	M. & N.	*119½	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co..................1st 5s	....	....	......	......	*106½	......

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Nov 7, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115⅛	117
Baltimore Traction Co........1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115½	116
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103	101
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	116	1 7
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	102	103
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	117	119
City & Suburban Ry......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	115	115¾
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113½
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	120

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st.mtg.bds.

Boston, Mass.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104	104¾
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105¼
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	..
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	..

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102	102¼
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	105½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	62½	......
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¼	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	...	......
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	101½	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	106½	107
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	107¼	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	101	......
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	95	......
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Nov 7, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov.St. Ry. 1st Con.mtg. g.5s	3,000,000	2,500,000	1922	J. & J.	105¾	106
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc.Cons.mtg.5s	531,000	531,000	1906	M. & S.	108	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	......	118⅛
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	....	135

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	105⅛	106
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	105¾	106
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	104	104½
†Cleveland Electric Ry.Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1918	M. & S.	103	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
*a*East Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102½	108½
Ft. Wayne (Ind.) Elec. Ry.1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	...
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	98½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1913	M. & S.	108	......
New Haven (Edgewood Div.)1st mtg.5s.	250,000	250,000	1914	J. & D.	107	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. [illegible]	100,000	[illegible]	[illegible]	M. & S.	102	......

New Orleans La.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR..........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR.............1st mtg. 6s.	....	50,000	1899	M. & N.	101	...
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83	83⅛
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	....
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	104	104½
N. Orleans & Carrollton RR.2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	......	.
‡St. Charles St. RR. Co......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	105	......

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn).1st gen. mtg.5s.	759,000	759,000	1909	M. & S.	108	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	109	110⅛
‡Bro'dway & 7th Ave.1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	121½	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111⅛	114
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	116	1 7
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	101	105½
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	115	[illegible]
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	111	117
¶Brooklyn,Bath & W.E. RR.Gen.mtg.5s.	1,[illegible]00,000	448,000	1933	J. & J.	85	[illegible]
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	101	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	109½	110⅛
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	103	105
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	104½	104¾
Bleecker St.& Fult'n Fer'y RR.1st mtg.7s	700,000	700,000	1900	......	102[illegible]	105
Cent P'k, N. & E. R. RR.1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	109	1 1
Central Crosstown RR..........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	1 2
Coney Island & Brooklyn RR.1st mtg.5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R.gen.mtg.g.5s	1,000,000	930,000	1932	J. & D.	115	116
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	100½	102½
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	114	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	98	100
Lex. Ave. & Pav. Ferry RR.1st mtg.g.5s.	5,000,000	5,000,000	1993	M. & S.	122	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1[illegible],500,000	1997	F. & A.	115½	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	1[illegible]5	116
Second Avenue Ry...............Deb. 5s.	300,000	300,000	1909	J. & J.	......	......
Steinway Ry. (L. I.)........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115⅛
South Ferry RR. Co...........1st mtg. 5s.	850,000	850,000	1919	......	110	114
Third Avenue RR.............1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	125	......
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	108	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	118	114½
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1948	J. & J.	111½	112⅛

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Nov 7, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry...........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	105½	105¾
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry................1st mtg. 5s	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co.................Col tr. 4s	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry..........1st mtg. 7s	....	......	1905	......	....	....
West Phila. Pass. Ry..........1st mtg. g. 6s	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry.............2d mtg. 5s	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	94	......
Central Traction Co................1st mtg. 5s.	375,000	375,000	1930	J. & J	......	....
Citizens' Traction Co..............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	115	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	112½	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	......	......
Pittsburg, Crafton & Mansfield............5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	105¼	....
Pittsburg & West End..........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	....
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	......	......
Second Ave. Traction Co.....................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	108½	109½

St. Louis.

Date of Quotation—Nov 7, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s	250,000	250,000	1913	J. & J.	101	103
Cass Ave. & Fair Gds. Ry.......1st mtg. 5s	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co..............1st mtg. 6s	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1913	J. & J.	111½	112½

*With interest. *Unlisted.

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Nov 7, 1898.						
Jefferson Avenue Ry ....1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co. ....1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co.	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co. ....1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	103
People's RR. Co. ....1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co. ....2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co. ....Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co. ....1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry. ....1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	102½	103½
St. Louis & Sub. Ry. ....Income 5s.	300,000	300,000	....		60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry....1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	112	113
Union Depot RR. Co...1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co. ....Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	114½	115½
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bonds.						
San Francisco Cal.						
Date of Quotation—Oct, 1898.						
California St. Cable RR....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	115½	117
†Ferries & Cliff House Ry....1st mtg. 6s.	650,000	650,000	1914	M. & S.	114½	......
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	100
Market St. Cable Ry. Co. ....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	128½	129
†Metropolitan Ry. Co. ....1st mtg.	200,000	....		....	......	......
†Omnibus Cable Co. ....1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126	......
†Park & Cliff House RR ....1st mtg. 6s.	350,000	350,000	1912	J. & J.	106½	108½
†Park & Ocean RR ....1st mtg. 6s.	250,000	250,000	1914	J. & J.	112	......
†Powell St. Ry ....1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	123
Sutter St. Ry. Co. ....1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Nov 7, 1898.						
Belt Ry. Co. ....O...s mtg 5s.	500,000	450,000	1920	J. & J.	51	....
Columbia Ry .... mtg. 6s.	500,000	500,000	1914	A. & O.	118	123
Eckington & Soldiers' Home .... mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	128	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Nov. 7, 1898.						
Bridgeport Traction Co. ....1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	101	106
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	115½	116
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	110	111
¶Columbus (O.) St. Ry. ....1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	108	105
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	109	109½
‖Cross't'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	102	102½
Denver City Cable Ry ....1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	116	117
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	1,050,000	1919	J. & J.	96	100
††No. Hudson Co. Ry. (N. J.).Cons. mtg. 5s	3,000,000	2,378,000	1928	J. & J.	104	......
No. Hudson Co. Ry. (N. J.)...2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry....Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry ....1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	100	100¼
St. Paul City Ry ....Cons. g. 5s.	5,500,000	4,298,000	1937	......	90	92
St. Paul City Ry ....Deb. g. 6s.	1,000,000	1,000,000	1900	......	90	92½
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Nov 7, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	103	....
Pittsburg, Pa.						
Date of Quotation—Nov 7, 1898						
Allegheny County Light Co ....6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light ....4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	......	......
Miscellaneous.—(Nov 7, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	110½	115
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	116¼	117
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	......	110	115
Edison Electric Light (Philadelphia)..	2,000,000	......			....	....
Edison Illg. Co. (St. Louis)	4,000,000	......	1923	F. & A.	....	....
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	......	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	......	1921	Q'ry.	......	....
United Elec. Light & Power Co (N. Y.)..	5,000,000					

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Nov 7, 1898.						
American Bell Telephone ....7s.			1898	F. & A.	102	....
Northwestern Telegraph Co ....7s.	......	......		......	......	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......		......	106	......
Chesapeake & Potomac Teleph. Co...5s.	......	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Nov 7, 1898.						
American Electric Heating ....6s.	500,000	500,000	....	......	.15	.19
Armington & Sims Eng. Co.	......	......		......	......	25
Barney & Smith Car Co. ....†6s	......	......	1942	J. & J.	97	100
Carborundum Mfg. Co. ....6s.	......	......	1904	M. & S.	....	....
Worthington Pump Co.	75,890	......	....	......	....	....

*Unlisted †Nominal.

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12⅜c.; Lake, 12½c.; casting, 12⅛@12¼c.

The Chicago Telephone Company declared a dividend of 1 per cent., payable November 5.

The West Chicago Street Railway Company has declared a quarterly dividend of 1½ per cent., payable November 15. Books reopen November 16.

The elections had a deterrent effect on the stock market, and there has been little or no change in the quotations of a week ago, Now that the battle is over more activity is looked for.

The North Hudson Light, Heat & Power Company of Hoboken, N. J., has filed a mortgage of $2,000,000 with the New Jersey Title Guarantee & Trust Company on its plant and fixtures. This is part of the proposed plan of reorganization.

Judge Ricks in the U. S. Circuit Court at Cleveland, O., has issued an order restraining the city from putting in force the ordinance providing for a four-cent fare on the street cars. The car companies intend to fight the matter in the courts.

The gross receipts of the Montreal Street Railway Company for the year ending September 30 were $1,471,939.65; operating expenses, $764,884.35; net earnings, $707,055.30; net income per cent. of capital, $13. Passengers carried, 35,353,036; transfers, 10,508,603.

The following Pittsburg, Pa., traction companies declared dividends payable November 7: The Duquesne Traction Company, dividend of 2 per cent.; the Pittsburg Traction Company, dividend of 3½ per cent., and the Central Traction Company, dividend of 1½ per cent. Books in each case reopen on the 15th inst.

Justice Pryor of the New York Supreme Court has appointed William B. Royce temporary receiver for the Middletown-Goshen Traction Company of Middletown, N. Y., on the application of the directors for a voluntary dissolution of the corporation. The company has a capital stock of $400,000 of which $200,000 has been paid in.

The Baltimore Traction Company has declared a final dividend of about 1½ per cent. This winds up the affairs of the company and distributes what was left of its assets after the absorption of the property by the Consolidated Railway, formed by merging the City & Suburban and the Traction companies. The dividend is payable to stock of record June 30, 1897.

An item from Philadelphia in the Boston "News Bureau" says: "The immediate scope of the people behind the $25,000,000 New York Gas & Electric Light, Heat & Power Company, among whom are Messrs. Widener, Elkins and Dolan, is to repeat in New York what they have done in Philadelphia. This scheme comprehends consolidating all the electric light business of Greater New York."

The actual sale of the controlling stock of the Nassau Railroad Company of Brooklyn, N. Y., by R. T. Wilson to Edward H. Harriman is reported, and it is thought to be the first step in the direction of the consolidation of the Brooklyn and Manhattan surface railroad companies, a combination that may also take in the Kings County Electric Light Company and probably the Brooklyn elevated roads. Roswell P. Flower and Anthony N. Brady are said to be back of the Nassau stock purchase.

The Brooklyn Elevated Railroad, the Union Elevated Railroad and the Seaside & Brooklyn Bridge Elevated Railroad are advertised to be sold under foreclosure at the Real Estate Exchange, Brooklyn, N. Y., to-morrow, November 10. After the sale the companies will be reorganized on a plan which provides for the issuance by a new company of $13,000,000 common stock, $5,000,000 non-cumulative 5 per cent. preferred stock, and a first mortgage for $16,000,000, bearing 4 per cent. interest till 1905, thereafter 5 per cent.

Judge Hallett, in the United States Circuit Court at Denver, Col., has entered decrees of foreclosure and sale against the Denver City Cable Company and the West End Street Railway Company in the suits brought by the Central Trust Company of New York on the ground of default in payment of interest on mortgages. Bonds were issued by the cable company to the amount of $4,000,000, and by the West End Company to nearly $500,000. Sanford C. Hinsdale, United States Commissioner, was named as special master in chancery to sell the two properties. He will advertise both sales in Denver and New York for thirty days.

The case of the old bondholders against the Somerset Railway Company, which has been pending in the courts for several years, has finally been decided by the United States Supreme Court in favor of the defendants. This confirms the title to the property in the present holders and establishes beyond question the validity of the $225,000 of bonds which were issued to pay for building the extension from North Anson, Me., to Bingham. The suit was originally brought by certain holders of the bonds who had refused to exchange them for stock in the corporation, claiming that the foreclosure was illegal and that the new corporation had no legal title to the road.

The Fair Haven & Westville Railroad Company and the New Haven Street Railway Company have been consolidated, the former company becoming the owner of all the properties of the latter. The Fair Haven & Westville Railroad Company was formerly capitalized at $900,000. The capital stock of the new company is now placed at the sum of $2,000,000. The Fair Haven & Westville Railroad Company pays the New Haven Street Railway Company for their new acquirement the sum of $500,000 in cash and $200,000 in bonds, making $700,000 in all. The $500,000 is to be raised by one year's notes at 4 per cent., and may be paid by further issue of stock by the company. The Fair Haven Company gives $900,000 of the new stock to its own stockholders.

A number of leading business men and capitalists of Baltimore are forming a stock company for development and improvement in Maryland, and it is likely that the company will be speedily incorporated. The banking house of Hambleton & Co. is financing the enterprise, and associated with the firm in it are some of the most conservative and leading men of Baltimore. The capital stock will, it is said, be between $1,000,000 and $2,000,000. The proposed company has a charter from the Legislature granting it extensive powers, which will enable it to buy, sell and deal in real and personal estate, to borrow and lend money, to acquire land and lay out towns, to subscribe and hold stock in manufacturing and other corporations, to erect, sell and lease buildings, to establish summer resorts, to construct and operate steam and electric railroads, telegraphs and telephones anywhere in the State of Maryland, subject to the approval of the county or city authorities, and to lay tracks upon streets and public highways anywhere in the State. It also confers the power to condemn property.

Advices from Cleveland, says the Philadelphia "Stockholder," state that it is reported that the "Little Consolidated," properly entitled the Cleveland City Railway, is about to absorb the Cleveland Electric Railway, known as the "Big Consolidated." Moreover, the Interurban Electric Railway, comprising the Akron Bedford & Cleveland, the Cleveland, Painesville & Eastern, the Lorain & Cleveland, and the Cleveland, Berea, Elyria & Oberlin, is to be included. Interests in the latter may turn out to be the dominating force of the entire outfit. Should the plan be consummated it will bring under single control about 286 miles of track, comprising the entire street railway system of Cleveland, and extending thence to Painesville on the east, Akron on the south, and Lorain and Oberlin on the west. All of it is electrically operated excepting 84 miles of the Cleveland City Railway, which is a cable road.

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CONTENTS.

EDITORIAL NOTES.

Electricity from the Tides. That an immense amount of tidal power is daily allowed to run to waste in the vicinity of New York City has long been known, and some time ago in an editorial we attributed this fact to conservatism, or if not lack of progress, a slowness in availing ourselves of opportunities. Probably one of the principal reasons, however, why the power derivable from the tides in both the Hudson and East rivers has not as yet been made use of for generating electricity has been owing to the fact that machinery especially adapted to meet the peculiar exigencies and requirements of such work would have to be designed. The old form of tide wheel which was made use of years ago for the generating of power wherewith to grind grain and saw logs would naturally be uneconomical in operation and totally inadequate to the present demands, and no new form of tide wheel has as yet been placed on the market suitable for work of this nature owing undoubtedly to a lack of demand for such machinery. Another cause which has probably had considerable weight in preventing the utilization of the tides in the North and East rivers for power purposes, has been the knowledge that such an undertaking would entail an immense expenditure of money for rights and privileges as well as for a power plant, without a certainty of obtaining satisfactory results from an engineering and financial standpoint. However, if reports are to be believed, a company is at present being organized in New York City, with a capital of $1,000,000, to build and operate a tide-water plant, and the necessary steps are being taken toward the securing of the requisite franchises. The promoter of this undertaking is said to be Mr. Thomas Edison, Jr., who has likewise devised and drawn plans for all the necessary machinery. The plant if built will consist of two metal pipes 15 feet in diameter and 100 feet in length, located under water in the channel and mounted on a solid masonry foundation. These pipes are to be pivoted in the middle and made to act as walking-beams through an automatic device actuated by the water flowing through them. The ends of these pipe walking-beams, as they might be termed, will then be made to operate the piston rods of compressed air cylinders. The compressed air obtained in this way it is proposed to utilize for running triple expansion engines which will in turn operate dynamos. The plant will be reversible, that is, capable of operating whether the tide is running either in or out, and at high and low tides, during the time the water is practically stationary, compressed air will be drawn from a set of storage cylinders to keep the electrical machinery in continuous operation. Whether a plant of this description would work satisfactorily remains to be seen, although it is claimed that a somewhat similar tide water power station recently tried in California has proven very successful. One thing would seem certain however, and that is, that were such a plant erected and run in the vicinity of New York City, even assuming that it was capable of generating but 6,000 HP. for five hours a day, the saving in fuel over a steam plant would about pay the interest on the $1,000,000 invested.

* * *

The Result of Invention. It has often and truthfully been stated that coming events cast their shadows before, but it may well be wondered whether the founders of this Republic had any idea of the magnitude of the results that would accrue from the work which they started; it might truthfully be said that they builded better than they knew. The progress of this country has never been more marked than in the past twenty-five years, during which time we have advanced from fourth among the exporting nations of the world to the second place, for to day it is a well-known fact that we stand second only to Great Britain, and it is reasonably safe to assume that before another quarter of a century shall have rolled by we will have attained the front rank among the manufacturing nations of the world. It is of course also well known that the inventive genius with which the people of this country are endowed has been the principal means of placing us where we are to-day, and it is upon well-established facts in possession of the United States Patent Office that we are able to sustain our plea for second place. Probably no one recognizes this more clearly than Mr. A. P. Greeley, Assistant Commissioner of Patents, who recently delivered an interesting address on this subject.

Foreign statisticians have been quick to grasp the significance of the figures bearing on the export trade of the leading nations. They have seen the rapid and steady growth of the United States during the past twenty-five years, and they have been prompt in the institution of comparisons.

The increase in manufactures of this country since 1860 forms the most remarkable feature of our growth in exports, and Mr. Greeley is of the opinion that it is undoubtedly due to the improvements in machinery made through the practical application of patented inventions. The direct bearing which these patented inventions have upon the exports of manufactures is shown by taking certain classes of products and comparing their export values for 1898 with those of earlier years. Take for illustration the year 1873, when instruments and apparatus for

scientific purposes, including telephone and other electrical machinery, were not included among the exports of this country, yet the records for the past year show that $ 2,770,803 worth of this class of manufactures has been exported. Another comparison worthy of note may be found in the fact that from 1873 to 1898 a jump was made in the value of the exports of iron and steel and manufactures of the same from $13,645,027 to $70 367,527. Patented inventions or the product of patented machinery are responsible for the export of agricultural implements such as mowers and reapers, for until 1887 but little was done in this class of manufactures so far as exportation was concerned, and in fact no very extensive shipments had been made prior to the year 1891. The same is true of electrical apparatus and instruments, which at the present time have become important items of the export trade.

* * *

Wonders Never Cease.

The ending of the nineteenth century would certainly seem to be fertile in wonderful projects for the utilization of electricity, and the later developments, if they do nothing else, nourish the impression that the future has in store many surprises in electrical research. First, wireless telegraphy made its appearance and was shown to be practicable up to a certain distance and under suitable conditions. Next it was announced that a method of seeing by electricity had been devised, but although considerable has been written on the subject the exact method of accomplishing this wonderful feat has been kept more or less secret. But a few days ago the world was startled by the announcement that Mr. Tesla had taken out a patent for a method of transmitting electrical power through the upper regions of the atmosphere without wires. According to the inventor, his device could be made to revolutionize modern warfare, as by the simple turning of a crank a vessel miles away could be made to start, stop or move in any desired direction. This, it is claimed, would be accomplished by placing on the moving body, whether ship, wagon or balloon, special mechanical devices. As in all cases of startling announcements, the lay press has taken the subject up and published alleged interviews with Mr. Tesla, bearing on the subject, of a most extravagant nature.

That Mr. Tesla has taken out patents on inventions of great value, and that he has contributed materially in this way to the progress of the electrical industry, is not to be doubted, but it is to be deplored that when the time is ripe for announcing to the world a new discovery or invention, Mr. Tesla does not see fit to do so before a body of scientists working in the same field, who would be in a position to thoroughly appreciate the advantages and disadvantages of the new idea. Instead however of promulgating the discovery through the medium of some recognized scientific society, the sensational dailies have usually been the first to get hold of it and have published alleged interviews and illustrations that were apparently devised to astonish rather than explain. Under these circumstances it is not to be wondered at that men of science look upon an announcement of this kind in a skeptical manner to say the least.

For instance, Prof. Cyrus F. Brackett of Princeton University considers Mr. Tesla's invention as totally impracticable, and says:

"The shortest, most correct and most complete criticism which I can make in reference to this bold boast is that what is new about it is useless, while that which is useful had all been discovered by other scientists long before Tesla made this startling announcement. You will find the whole theory which he has applied in any up-to-date text book. What Tesla has done is simply to make theoretical application, which would prove to be absolutely ridiculous in practice, of inventions which had already been discovered.

"There is nothing new about this. The theory is perfect, but the application absurd. So throughout Tesla's whole elaborate scheme, the theory is not at fault, although there is nothing original about it, but the circumstances under which its application would be necessitated are such that the only result would be failure."

The following statement by Prof. Dolbear of Tufts College, which recently appeared in the New York *Herald*, comes very near to expressing our own views on this subject:

"This last so-called invention of Nikola Tesla's is a very pretentious affair, and it is so incredible that the story is not to be believed until the work is actually done. If Tesla said all that the *Herald* quotes him as saying, then his whole scheme and his manner of working is unintelligible to me. He even says that 'this power can be exerted at any distance by an agency of so delicate, so impalpable a quality, that I feel I am justified in predicting that the time will come when it can be called into action by the mere exercise of the human will.'

"That is getting a little outside of science, but you will notice that Tesla himself is only predicting that this will come true. There has been no accomplishment. He proposes to do great things, but he does not tell how he is going to do them, and he hasn't done them himself yet.

"The announcement is most amazing, and coming as it does from Tesla, scientists are all the more chary about accepting it. During the last six years he has made so many startling announcements and has performed so few of his promises that he is getting to be like the man who called 'Wolf! wolf!' until no one listened to him. Mr. Tesla has failed so often before that there is no call to believe these things until he really does them. Meantime we are all waiting with much patience and without solicitude. We will believe them when they are done."

Under the Searchlight.

Notes and Comments on Various Topics.

PROF. R. B. OWENS, the new professor in charge of the electrical department of McGill University, Montreal, is introducing a new feature which will be of great value not only to the students but will also confer great benefits upon the general public. This will be a standardizing laboratory. There will be a room devoted to high potential machinery where a voltage of 200 000 will be obtainable. There will be machines of the various types, and new types of high tension transformers and alternating current machinery are being installed.

* * *

RUDOLPH M. HUNTER of Philadelphia has invented, so it is said, an electrically operated telescope which if ever built will be many times more powerful than that in the Lick Observatory. The principal feature of Mr. Hunter's invention is an inclined spiral track on which runs an enormous truck supporting a focusing apparatus consisting of an immense concave mirror. In the center of this track a tall observation tower will be placed so designed that the upper portion may be either raised or lowered electrically. Mr. Hunter firmly believes that a telescope built according to his design would be 500 times more powerful than any now known.

* * *

THE new switchboard which we referred to a few weeks ago as about to be tried by the New York Telephone Company was put in service at Harlem on the morning of the 13th inst., and is said to have so far given satisfactory results. As we explained in our former item, the removal of the receiver from its hook lights a tiny electric lamp by the side of the telephone number on the switchboard. Likewise when connection has been made another lamp is automatically lit and remains lighted until the receiver is returned to its hook.

* * *

"ALL this political excitement recalls my brief career as a candidate," mused a citizen the other day who now limits his practical politics to voting. "I was living at the time in a district where the people had a good Congressman and most of them were in favor of keeping him. But, of course, there was a dissatisfaction, as there always is, and by an immense amount of hustling for three days and nights preceding the convention, I was nominated.

"My party had a good safe normal majority, but I knew that some of its members were out for revenge and we made things hum. There was but little time in which to do a great deal, for the old organization was lukewarm and I had to perfect another one. I kept the wires hot to all parts of the district, and I was never more pleased than when a bright operator from another city came to me with his advice. He urged me to send all my dispatches to my chief lieutenant in cipher. Then I could say just what I wanted to and the enemy would be none the wiser. He would handle the matter for me if I would just have a wire run into my headquarters. He arranged the cipher and used it with wonderful skill. All I had to do was to write what I wanted to send and he did the rest. I kept him at that key from morning till late at night, and he never complained. Indeed, he often suggested things that I had better explain and orders that I had better issue. Everything went on as though it were greased, and I was dead sure. But I was simply slaughtered. My operator was in the employ of the opposition. All it had to do was to check my moves. I was in debt up to my ears and was laughed at for the way I had been taken in. I went to work, got even with the world and was happy. I wouldn't run for President now if the salary was paid me in advance."

* * *

THE Spanish papers waste no words, according to the *Electrical Engineer*, London, whenever they have a chance to attack the stranger within or, for the matter of that, without their gates. It appears that recently the rain flooded the boxes on the mains of the electric lighting company and the light went out in the theaters. That was bad enough, but it also caused Egyptian darkness in the printing offices of the *Heraldo de Madrid*. Considering how badly Spanish papers are usually printed, we should say that they want all the light they could get to do it in. However, next morning a leader appeared, in which it was said: "Every time four drops of rain fall in Madrid the *magnificent* (the italics are the *Heraldo's*) installation of the English company shines out (?) conspicuously." After describing the damage done and bewailing the frequency of the occurrence, the Government is asked to look into the matter and to compel the company to lay its cables in a more efficient manner, especially as it had managed to formulate its contracts in such a way that no one could claim compensation for any damage caused by these frequent mistakes.

* * *

IN a recent report issued by the United States Geological Survey the production of copper during 1897 is given as 491,638,000 lbs., an increase of 7½ per cent. over the previous year.

New York Electrical Society.

Mr. E. H. Johnson will lecture before the New York Electrical Society on Thursday evening, November 17, at 8 P.M., at the College of the City of New York, Lexington avenue and 23d street, on "Surface Contact Railways, with special reference to the Johnson-Lundell System."

LONDON NOTES.

[From our London Correspondent.]

Northern Society of Electrical Engineers.

This Society has just opened its winter session at Manchester with an address by the president, Mr. J. S. Raworth, who took for his text "The rapid development of electrical engineering during the present year." He quoted as an instance of the great progress which is being made in electrical work in England the enormous increase in the capital invested in electrical companies. Mr. Raworth calculates that of every £100 applied to the purposes of electric lighting, £37 went to the manufacturer of plant—engines, boilers, dynamos, etc.—and £34 to the manufacturer of cables. A backward branch of electrical work is the propulsion of boats. There is only one active company on the Thames, but the speaker looked with confidence to the development of that branch in the future. Touching upon the distribution of power, the president said they were in the midst of a scheme which would commend itself not only to electricians and engineers, but to the country generally, as a most practical development; he referred to the Trafford Park scheme. That was an undertaking to supply power in bulk for driving and lighting all the factories, warming all the houses, and in fact doing everything that was necessary except the supply of education. The scheme would be but the nucleus of a very much larger development.

Mr. Raworth's most interesting remarks were made upon the use of American made electrical machinery for English works. He said that it was a very good thing that at present English electricians had the possibility of getting the plant they wanted from America, because were it not for that fact there was no doubt the development of electrical enterprise in England would now be suffering very great strangulation. So far as he could see, Americans were only supplying those orders which we could not execute in England. He hoped no one would lose heart by seeing plant coming into England, but that they would persuade their friends to subscribe to new companies coming out for the manufacture of things which they now had to purchase abroad.

Municipal Telephones.

There is every reason for believing that the granting of telephone licenses by the Postmaster General for the establishment of municipal telephone services is to be pretty general if Councils continue to apply for the necessary permission. We have already mentioned the granting of the Glasgow license. The Huddersfield municipality also has learned that a license will be granted, and Manchester is similarly placed. Judging by the expressions of feeling in many large towns, the desire is pretty general, but in all cases the licenses will only extend to December, 1912, when the National Telephone Company's powers lapse. The municipalities are in some cases wondering what will happen to them at that date. Parliament has yet to confirm the policy of the Postmaster-General. Manufacturers of telephone apparatus are naturally looking for some improvement in business if municipal exchanges are established.

Liverpool Electric Trams.

The Liverpool Corporation has recently completed its short experimental section of overhead trolley tramways at a cost of about £50,000. The line is not yet in actual operation, but the Corporation has resolved upon the equipment of another short section and is considering a proposed scheme for the preparation of 18¼ miles of existing track for electricity and the construction of 8½ miles of new system, also for electrical working. The cost of street works for these lines, exclusive of course of overhead or underground equipment, is put down at £91,250.

ELECTRICAL ALARMS.*

BY J. EBEL.

Considering the large variety of electrical apparatus designed for commercial or domestic purposes, one is impelled to the conclusion that there is hardly any article of such wide-spread and universal adoption as the electric trembling bell, but notwithstanding the enormous output of this particular article, its form and device has apparently, with a very few exceptions, undergone no material alteration from the original type.

Since the introduction of the dry battery, which has now reached a condition bordering upon perfection, a little more progress has been made with regard to the compactness, utility and convenience of a suitable combination of the alarm and battery. A general description of some improvements in this direction may afford considerable matter of interest to many of your readers.

Fig. 1 represents a standard pattern of electromagnet with armature hammer and break contact bracket. There is nothing particularly new in this combination, its novelty and merit resting solely upon the compactness and simplicity of its general arrangement, thus facilitating the rapidity and cheapness of manufacture. The electro-magnet is secured to a board by means of a screw and washer; two little projections being pressed into the wood

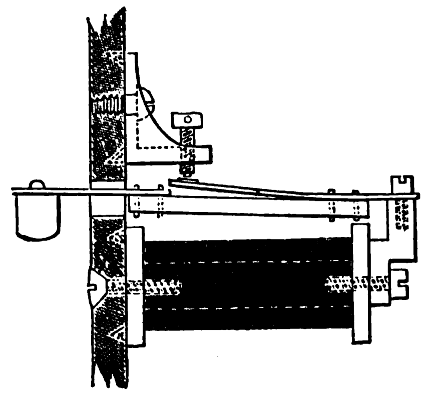

FIG. 1.

render it firmly secure. The hammer and contact spring are riveted to the armature and secured to the electro-magnet by means of a brass bracket and two screws.

The contact bracket, which is fitted with an adjustable contact screw, is secured to the woodwork as shown. This combination is condensed to the extent that it can be conveniently encompassed in the small space of 1 x 2.5 inches.

Fig. 2. is a section of a double alarm and battery combined, which consists of a portable case of dimension 6 x 6 x 3 inches, containing two Siemens dry cells, type O, sufficient space being allowed between these to accommodate two electro-magnets, whose hammers reach through suitable openings in the case placed in such a position that it enables them to strike the bells which are upon its exterior. The two bells differ from one another, both in size and pitch, which, since they are intended to work independently from the same battery, is necessary to form a marked distinction between them. It will also be evident that it can be arranged to work a single alarm.

Fig. 3 is a sectional view of another type of alarm known as the "Rattler." The principal feature attending this class lies in the fact that it is dust-proof and watertight. This device, with the exception that the bell is entirely dispensed with and a diaphragm substituted, is similar to the arrangement shown in Fig. 2; the electro-magnet hammer assumes a vertical position, and by its action strikes the diaphragm, which is so situated that the opening in the side of the case is completely covered by it on the interior, while the exterior side of the opening is covered by a sounding board which has a small hole in the center of it; the action of the hammer upon the diaphragm produces a strong vibration and a rattling noise from which the name of the apparatus is derived. From this description it will be observed that the case is securely closed in upon all sides.

Fig. 4 is a diagram of a burglar alarm. The usual principle of those in general use consists of

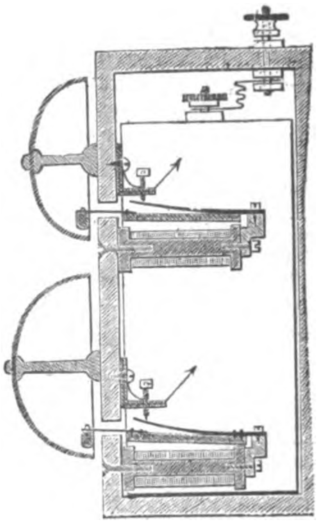

FIG. 2.

completing the circuit by means of opening or closing doors or windows to which contacts are fitted, and then connected up to the ordinary pushes, the bell ringing immediately the circuit is completed. The principle demonstrated by the accompanying diagram is, however, the reverse to the one described inasmuch that the alarm comes into operation immediately upon the circuit being broken; by this means a decided advantage is gained, because the slightest defect in the line through tampering, or any other reason, would at once be made known by the alarm, whereas in the former instance similar defects would render the apparatus useless for its designed purpose, and moreover, its defects could not be discovered without some trouble and testing.

The form of this apparatus resembles that of Fig. 1 or Fig 2, the only exception being that the electro-magnet solenoid is wound with two wires, one of a somewhat large dimension and having a resistance

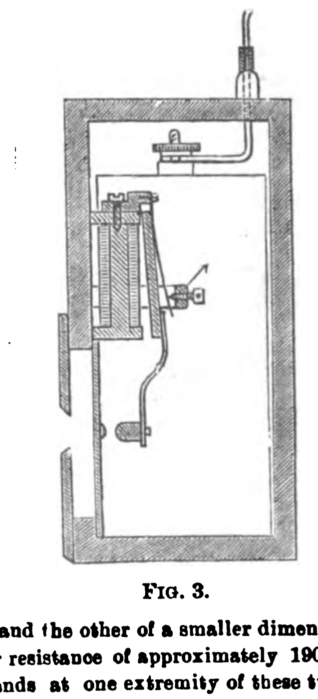

FIG. 3.

of 10 ω, and the other of a smaller dimension giving a higher resistance of approximately 190. The adjacent ends at one extremity of these two coils are joined together and permanently connected to the armature hammer or contact hammer, the other two ends by making an intermediate connection with the contact screw, C, are connected to the poles of the battery in such a manner that the current passing through the two coils would for each coil produce

* From the *Electrical Review*, London.

the same polarities on the extremities of the electro-magnet. The position X is the operating part in the out-going circuit, which operative effect can be arranged in numerous ways, i. e., by an opening contact spring attached to a flexible twin wire which is squeezed into the slot of the door, window or sash; this insertion falling out of its position when the door is opened, at once breaks the circuit and gives the desired result; again, the circuit between the points A B may be closed with a very fine wire,

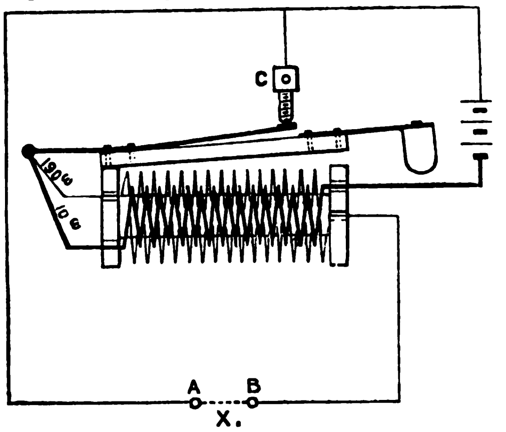

FIG 4.

almost invisible to the naked eye, and placed in any position where it is most likely to be broken; this affords a simple and expeditious method of obtaining the effect required, and which is explained as follows:

When the apparatus is adjusted for action the battery current passes through the two wire coils and forms a circuit. The electro-magnet with its highest resistance, which in this instance is 200ω becomes sufficiently excited to cause a slight descent of the armature from the contact screw, E, and thereby causes it to permanently maintain this pendulous position. The line being broken at X would cause the fine wire coil to be thrown out of the circuit, whereupon the circuit being now open, the armature would return to the contact stud, E, and thereby establish the make and break alarm circuit having only the thick wire coil retained.

Fig. 5 shows an entirely new form of electric alarm for very large sizes. Whereas the ordinary alarms working upon the "make and break" system are only satisfactory up to a limited size (say 6 inches diameter of bell), it is also obvious that the larger the alarm the greater must be the vibratory amplitude of the hammer taps, and the intervals of

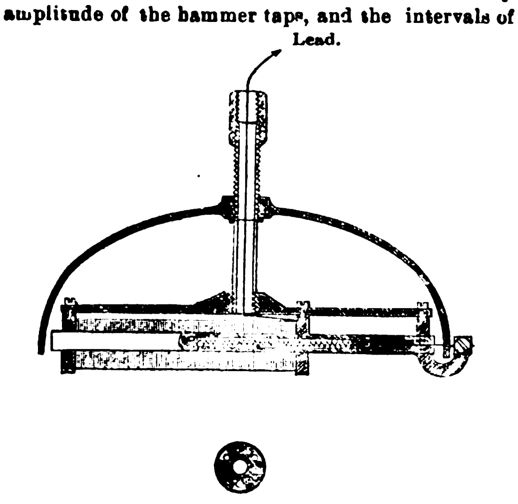

FIG. 5.
Top View enlarged of Brass Tube. Wrought-iron Core with steel balls.

proportionately longer duration, which result is practically unattainable by the present system, although it could be partly approached through the application of a larger electro magnet. This method, however, necessitates a larger battery power, and consequently produces the great disadvantage of excessive sparking at the points of contact, thus bringing about a rapid destruction of those parts, and furthermore, the make and break system cannot be worked either in series or in parallel, since each bell, for perfect working, requires its own circuit.

The section, Fig. 5, shows a solenoid wound round a brass tube, which contains an automatic, adjustable, hollow iron core. This core is provided with three longitudinal grooves for the accommodation of small steel balls, thus affording a practically frictionless longitudinal movement; the interior of the core contains a helical spring of suitable tension, having one of its extremities secured to the core, and the other attached to a fixed point situated as shown. The entire combination of parts is secured to a substantial bracket by means of screws, and by a piece of gas tube of suitable dimensions is suspended within the interior of a large gong or dome which forms a cover to the whole arrangement. The circuit is governed by an ordinary solid contact button or switch. When the circuit is open, the core, which answers the purpose of a hammer, assumes its normal position as shown, but immediately upon closing the circuit the core is drawn rapidly to the left and makes impact with that portion of the gong, and immediately upon breaking the circuit the recoil of the spring compels the core to produce another blow upon the opposite portion of the gong, i. e., to the right; thus it will be seen that action and reaction produce alternate blows, the rapidity of which may be varied "*ad lib*" according to the size of the gong. To especially adapt this gong for *continuous ringing*, I have conceived a device consisting of a combination of gear wheels and an escapement wheel in conjunction with a spiral spring and winding key. The contact is produced by a star wheel, the points of which form a rubbing contact with an insulated spring strip. For exceptionally large currents carbon contacts may be used with advantage.

The simplicity and compactness of this alarm renders it peculiarly adaptable for cheapness of manufacture. Its great reliability of action being largely due to the rubbing contacts being made at the *sending* station only, also another advantage is that any number of gongs may be worked in any circuit, whether they are in series or parallel. This apparatus is especially adapted to do duty for time bells in large factories, mines, etc., where a number of them could be worked from the timekeeper's office.

THE THOMPSON-WALKER CONTACT SYSTEM.*

The paper on contact systems of electric traction read by Prof. S. P. Thompson and Mr. Miles Walker at the British Association at Bristol serves as a fitting introduction to the above subject. We have, therefore, held back the paper till we should have had an opportunity of inspecting the line equipped by the authors in a private spot at Willesden. This we were able to see last Saturday, and a better day could not have been chosen for the experiment, as rain had fallen, and the whole track was saturated with water. After the description given in the foregoing paper, a further detailed account is not needed, and we shall here confine our attention to considering the advantages and disadvantages of the system. As certain untechnical papers have given badly-written accounts of interviews with Prof. S. P. Thompson, in which distorted views of the advantages are given to the public, we are sure Prof. Thompson will forgive us if we are rather critical in our judgment.

Mechanical Features.—The arrangement of the studs in the center of the track does not differ appreciably from that devised by other experts in contact lines. We are assured by these gentlemen that a projection of ⅜ in. for the surface of the contacts over the level of the roadway gives ample allowance for the contact shoe. This we rather doubted, and we found on Saturday that 1½ in. projection was allowed as a rule at Willesden. This is, in our opinion, the great objection to all contact systems, and the objection of course increases as the roadway wears down. This disadvantage has to be balanced against overhead wires with the trolley system, and against the open slot with the conduit, but we think that the open slot is much less objectionable.

Public Safety.—The arrangement of switch gear below the contact in the Thompson-Walker system gives decidedly greater safety against leaving a contact alive than any other contact system we know of. This is obtained by the use of the magnetic effect of the iron contact shoe on the car. Without a mass of iron is over the contact the switch is not closed even if the normal current is flowing through the shunt coil of the operating solenoid. It is equally true that the core of the solenoid falls directly the iron shoe leaves it and thus breaks the circuit. In the event of the shoe not making contact with the point it is approaching, the whole circuit is broken and the car stops. With other contact systems a failure of the incoming contact also stops the car; but, as a rule, it runs on sufficiently far to leave a live contact exposed behind it. This live contact is bad from the public's point of view, but it gives the tram driver a chance of getting his supply again, as he can do by hand that which the shoe under the car failed to do.

We experimented with a newspaper on Saturday, and found that when moistened and laid over a contact it several times held the shoe up for a sufficient length of time to break the circuit. We used a *Daily Mail* for the purpose, and pulled up the car three times out of five attempts. This experiment reveals a defect which will entail a somewhat expensive addition to the equipment of the cars run on the system. In order to re-establish connection, they will have to carry a battery of accumulators capable of giving 500 volts and a discharge of at least a quarter of an ampere. The current is not so much a difficulty as the fact that about 250 small cells and their connections must be kept in order. These can, of course, be charged from the main circuit, but it will not do to leave them always in parallel with motors. When the contact is lost, as will somewhat frequently occur in streets which are not well swept, the controller handles will have to be brought back to open circuit before the small battery is put on to pick up the connection to the main.

The Switch Gear.—The present form of switch gear used is very ingenious, but we do not believe that it will be satisfactory in extended practice. In the first place, mercury contacts are used, and they appear to be light for the current required in starting. Mercury contacts have given great trouble, even where readily accessible, and we are sure the inventors are wrong to put them in buried switches. The next point is the shunt coil, in which 500 volts are used. This is a high voltage for the primary current; and as it is often made and broken, the insulation required must be good. Dry oil must be used in the vessel to prevent the insulation depreciating. We entirely disagree with the statement in the pamphlet describing the system where it says: "The insulation for the winding of the magnet is most simple. It need only be of the most primitive kind, because the inner end of the winding is connected to the reel and the outer end to earth." There is another mis-statement in the pamphlet. It says: "When the plunger falls, it 'earths' the stud and blows the feeder fuse in case the stud has not been disconnected, thus affording, in any such event, absolute security against accident. This method of earthing is believed to be more reliable than anything which has hitherto been proposed, because it is dependent upon nothing but the action of gravity and the continuity of a stout earthing conductor."

Our readers after glancing at this extract will be

* From the *Electrical Engineer*, London, October 28.

surprised to hear that the reliable action is a myth. The stud is never earthed by a stout earthing conductor, as is stated, and if it was, the contact shoe would, by putting 500 volts direct to earth, blow every fuse in circuit. The plug is earthed through the high resistance of the shunt coil and the earth connection is not sufficiently good to give safety. This the inventors have endeavored to provide in other ways by preventing leakage currents to the idle studs.

Comparison with Other Systems.—Comparisons between contact systems and the trolley system are useless, as where the overhead wire can be used neither the conduit nor the surface-contact system can compete on account of the much higher capital cost and of the greater cost of upkeep. Our comparisons must therefore be confined to the conduit system. Leaving the question of price till later, there is no doubt that the well-designed conduit is better from an engineering point of view. The contact systems (not Prof. Thompson's in particular) require a large number of automatic switches in the roadway, say some 300 per mile, and the failure of either of these disorganizes the whole traffic for a few minutes at least, and piles up all the cars behind the fault. The next point is an electrical one. Prof. Thompson is represented by an evening paper of repute to say that his system will cause less electrolytic troubles to surrounding gas and water pipes than the conduit. This is quite incorrect, and we trust that the reporter is to blame. All modern conduits are being constructed with insulated return conductor, so that earthed return through the rails need not be used. In this respect the Thompson-Walker system is no better than the trolley system, and the rails will have to be most carefully bonded and provided with return feeders to prevent trouble.

A comparison of first cost is made by the inventors, which reads as follows:

COST PER MILE OF SINGLE TRACK.

I. *Overhead Wire System.*

Trolley wire and adjuncts	£300
Poles	£400 to 1,200
Permanent way and paving	3,500
Feeders	4,000
	£8,200 to 9,000

II. *Open Conduit System.*

Cost of conduit under favorable conditions, including conductor rails, insulators and drainage	£3 900
Permanent way and paving	3,500
Feeders	4,000
	£11,400

III. *Surface Contact System.*

180 to 360 boxes costing, say, £5 a-piece	£900 to 1,800
Permanent way and paving	3 500
Feeders and adjuncts	4,200
	£8,600 to £9,500

These last figures will not bear criticism. Thus, with the overhead system £300 is allowed for the trolley wire and adjuncts. On the surface-contact system this is reduced to £200, added on to the feeders. This small sum of £200 has to provide a mile of insulated conductors laid and jointed. The cable unjointed is likely to cost considerably more than £200. When it is considered that from 180 to 360 joints per mile have to be made, the total inadequacy of these figures is apparent. As regards the joint-boxes, these are not at present incorporated in the switch gear under the contacts, but may be in future. At any rate, the estimate includes nothing for this considerable item. The switch boxes themselves are put down at £5 each, and we see no reason why they should not be made for this, but judging from other electrical supplies there is little, if any, profit at this figure. As to how the development of the system is to be undertaken we know nothing, but it must be remembered that the inventors' royalties have to be capitalized and added to the corrected estimate. With this added, we think that the final price will not be appreciably cheaper than the conduit. As a system the line is interesting and shows that the inventor knows how to take advantage of the previous attempts in the same field, but we do not think that the conduit line has been improved upon, either from an electrical or mechanical point of view.

ELECTRIC LIGHTING AS APPLIED TO ARCHITECTURE.*

BY THOMAS EKIN.

I assume that in this year of grace it is unnecessary for me to take up your time by dwelling upon the manifold and very apparent advantage of electric lighting over every other form of illuminant, whether it be considered from a hygienic, artistic, decorative, or even commercial point of view, and it is generally admitted there are very few individuals—excepting, of course, those interested in gas or oil companies—who will not honestly endorse this statement. At the commencement of this paper, then, it will be as well to state that I do not propose to touch upon or refer to the subject of electric lighting outside buildings; that is, upon the generating plant or other sources from whence electric energy is brought into the building or group of buildings, but rather to confine my remarks to internal lighting and the manner in which the current should be conveyed to the various points of light.

Dealing firstly with the distribution of lights, it is obvious that the lighting of different classes of buildings requires distinctive treatment, because the lighting of a cathedral cannot be compared with that of a railway station any more than the lighting of a ballroom or drawing-room can be compared with that of a bedroom or kitchen. Each room or space which it is intended to light should be considered and examined from at least three different points of view, namely:

(1) The purpose for which it is to be used.

(2) The decorations, furniture and general surroundings, and

(3) The cost of the proposed lighting.

Which of these three points is the most important is probably a matter of opinion, but it may safely be assumed that the third point, or question of cost, is not the least important, because it may be taken as granted that the skill of the architect or engineer in arranging a system of lighting is in no case more marked or apparent than in getting the maximum lighting effect at minimum cost, this minimum cost including not only the first cost of putting in the work, but the more important one of annual expenditure and renewals.

When considering the question of lighting new buildings by electricity, the subject can be treated and dealt with with a far freer hand and, generally speaking, with far greater effect than in the case of houses at present lighted by gas or other form of illuminant, because one is so very apt to take the positions at present held or assigned to gas as those most suitable for electric lamps, quite forgetting the fact that gas is so non-adaptable and lends itself with such ill grace to artistic effect that there are only certain positions in any room in which it can safely be placed. Now I shall assume as an axiom that the most perfect form of lighting is that evolved from a hidden system of lamps—in other words, where no portion of the lamps themselves are brought in direct contact with the retina of the eye. It is, however, only right to point out that this form of lighting, like many other nice things in this world, is, generally speaking, the most expensive, because, as a rule, it means the placing of the lamp or lamps under some form of shade, whereby a large portion of the illuminating power is lost, and, therefore, and in order to get the same effect or amount of light from hidden lamps as from ordinary unshaded or only partly shaded lamps, double or even treble the amount of energy has to be used. In public halls, concert rooms, churches, etc., the points of light can, if taken from the ceiling or roof, be raised sufficiently far above the heads of the audience that, unless they wantonly gaze at the lamps, no inconvenience to the eyes need necessarily be felt, but it is different in the case of ordinary rooms, be they drawing-rooms, boudoirs or dining-rooms; and it is these classes of rooms which in my opinion require the most careful thought as to the disposition and arranging of the lamps.

In dealing with this matter, it is perhaps unnecessary to say that I am dealing solely and wholly with the incandescent electric lamp, and that I do not propose to touch upon the question of arc lighting this evening, because, though this light is pre-eminently suited for streets, railway stations, and other similar places, it is not, and I believe never will be, suitable in any way for the internal lighting of buildings. Many of you here this evening must, at some time or other, have been struck with what is generally termed the "glare" of the electric light, and possibly may have thought that this was one of the inherent faults of the system. I need hardly say it is nothing of the sort, and the fault lies, not in the system, but in the brain of the stupid person who put it there. No sane man or woman, with any regard to their eyes, willfully stares at the noonday sun; but I submit it is just as idiotic to put up a clear electric lamp and gaze at it as it is to gaze at the sun. Electricity, like most other things, to be properly appreciated must be suitably adapted to the end in view, which, as before stated, is a diffusion of soft light, without the lamp from which the light emanates being brought in direct contact with the eye. I am fully aware that the cost of complying with this requirement is in many cases too heavy to allow of its being adopted, but I submit there is no reason why every electric lamp should not in some form or other be shaded, even if the shading is simply the putting in of an "obscured" lamp in the place of a clear one. It is evident, or at any rate should be evident, that the lighting of each particular room or space should be separately considered, and that being so, it is impossible to lay down any hard-and-fast rules as to what is necessary in each particular case; and it requires a certain, or I may go even so far as to say a good deal of practical experience and judgment to know the proper amount of light required, and also the position in which the lamps should be placed. Under these circumstances, therefore, I fear it is quite impossible for me to lay down any rules which would be of the slightest value in enabling you to properly arrange for the lighting of any building in which you are interested. There are, as you are doubtless aware, certain "rule-of-thumb" rules which are given in pocket books and similar literature, but I have never found them to be of the slightest value, but, on the other hand, rather misleading. Take, for instance, a drawing-room. What use is it to any one to know that a 16 candle power lamp will light a certain number of square feet of floor when raised a given height above it. In my opinion none, for the simple reason that it is quite impossible to take into calculation or make due allowance for the surrounding coloring of either walls or furniture.

Leaving artistic effect out of the question for the moment, it is evident nothing is easier than to drop a number of pendants from the ceiling, and if these are kept a certain distance from the floor, you can procure the maximum amount of light with the minimum number of lamps and cost. This mode of lighting is, however, not to be recommended; indeed, it is strongly to be deprecated, and when one sees a room lighted in the above manner, it is at once apparent that a Goth, Vandal, or other barbarian has had the arranging of the lights. I think it will be generally conceded that the most pleasant, and at the same time most artistic, method of lighting ordinary living rooms is by means of wall brackets, standard lamps and table lamps, the lamp in each case being shaded so as not to come in direct contact with the eye. With regard to the other rooms in a house, there is not, as a rule, much diffi-

* Read at the October meeting of the Architectural Association.

culty in assigning the right position for the lamps and their numbers, but at the risk of reiteration I would again impress upon you the desirability of considering the lighting of each room, or at any rate of each principal room, separately, and from the three points of view mentioned at the beginning of this paper.

Now the next portion of my paper has to deal with the manner in which the electric current is brought from the place where it enters the building to the lamps themselves, in other words, that portion of the work generally spoken of under the comprehensive term "wiring." As you are doubtless aware, this word "wiring" includes not only the supplying and laying of the various wires and cables, but also—at least, as a general rule—the switch and fuse boards and subsidiary switches, and occasionally the necessary "cutting away and making good," this latter expression being in many cases incorrect, as you, like myself, have probably found by experience that it could be more accurately described as "hacking and tearing away and not making good." Many of you have doubtless had before you the bids of some electric lighting contractors for the lighting or wiring of certain buildings, and, perhaps, have even gone so far as to draw up a common specification on which these various firms have bid, and you have doubtless been surprised to find that the highest bid is sometimes half as much, and in some instances as much again as the lowest, and furthermore have been puzzled to know what should be done under the circumstances. Of course, if no specification has been issued, the reason of the difference in prices is easily explicable, inasmuch as the contractors, having no common basis upon which to draw up their bids, simply send in an estimate for the work and material they consider necessary, with the result that if the contractor is an honest man, taking proper pride in his work and with a reputation and good name to lose, his prices must be, and always are, considerably higher than those of an individual whose commercial instincts have unfortunately prevailed and got the better of his moral ones. It is far otherwise, however, if the contractors have estimated on a common specification, because if there are great discrepancies in the bid it is evident either that the individual quoting the lowest figure is willing to forego all profit or else that the one quoting the highest figure intends to make a fortune. Neither of these hypotheses is probable or ever likely to occur in practice, and it will generally be found that the real cause of the differences may be found in the loose and unscientific manner in which the specification has been drawn up. For a skilful and perhaps unscrupulous contractor nothing is easier than to drive a coach and four through a loosely and inaccurately drawn up specification, whilst it is evident that even an honest contractor—being but human—will avail himself of every opportunity in interpreting an ill-drawn clause to his own advantage. Perhaps I may be considered wanting in courtesy in suggesting that you are likely to draw up a faulty specification, but I can assure you nothing is further from my thoughts, and my only object in speaking thus plainly is to insist upon the absolute necessity of drawing up the specification in the most careful manner and with a full knowledge of all the requirements necessary and incidental to the proper carrying out of the work. My experience has been that many points of vital importance to the work are—probably from want of technical knowledge—entirely omitted from many specifications, and others of no technical importance are treated with a fulness and amplification entirely unnecessary. What is the use of carefully specifying the density of current allowed per square inch of sectional area in the copper conductor, when the loss of pressure, or, to use a more technical phrase, the fall in voltage, or electro-motive force, is omitted? None whatever, because in the case of a light or group of lights, placed at some distance away from the source of supply or point from whence the electric energy is brought into the house, the contractor might possibly be carrying out his work strictly in accordance with the specification and yet the lamp or lamps would look like "hot hairpins," owing to the fact that the very essential point of loss of pressure had not been taken into account. Again, what is the use of specifying the most heavily insulated wire and omitting the final test when the work is completed? Instances like these could be given ad libitum, but for the purpose of argument this is unnecessary.

There are still two points upon which I should like to give a warning, and these are, firstly, the low-priced contractor who looks to make his legitimate (or, as some would say, his illegitimate) profit on fittings, and, secondly, the contractor who offers to put in the work so that it will comply with the ridiculously low requirements—I refer to the test of the insulation resistance—of the fire offices. In London and other towns where there are electric supply companies, this latter danger is to a large extent rectified and guarded against by the fact that all work has to pass the more reasonable standard of the supply company, but it still remains in the cases of country houses, and houses in towns where the owner or occupier generates his own electric energy.

CONTROLLING APPARATUS IN CENTRAL STATIONS.*

BY R. DUNNING.

The arrangements for controlling the plant in central stations often leave a good deal to be desired. There are switches, valves, gauges, instruments, etc., all over the works, and in many cases there is not a man in the place, from the engineer downwards, who could tell straight off what each belonged to. Now, all the plant in a central station—engines, boilers, generators, steam and water pipes, pumps, etc.—should be considered as one complete machine, a machine for making electric light; and the engineer-in-charge should be able to tell how all the plant is working without having to run about the station. He should be able to feel the pulse of the station, as it were, from the switchboard, so that in case anything goes wrong he may see at once which item of the plant is in fault.

The great idea in a central station should be to make everything as plain as possible in order to lose no time in a breakdown, where every second may be of importance, and to this end everything should be arranged so that it is almost impossible for the men to make a mistake. They should not have to stop to think which is the right switch or valve, but should be able to decide at once.

The switches, of course, are a very important part of the controlling apparatus of a central station. They should all be placed near together so that the attendant can see what each machine is doing without having to move about. The switchboard should be placed near the wall at the center of the engine-room, and raised some feet above the floor in order that the attendant may see all the dynamos and signal to the engine-driver more easily. No one but the engineer and switch attendant should be allowed near the board on ordinary occasions. All the main machine switches ought to be placed on one board. They are generally arranged on panels. Each panel is numbered to correspond to a machine, and contains the switch, ammeter and main fuse for that machine, and the dynamos being numbered in large figures, easily seen from the switchboard, there is no fear of the wrong switch being opened or closed by mistake. In alternating-current stations the exciters should have a separate switchboard of their own close to the main board, with the switch gear arranged in the same way, and each switch numbered. This will be easier for the switch attendant than if the exciter switches were arranged on quite a different plan to the main ones. It is important that the attendant should know the speed at which the machines are running, and reliable speed indicators should therefore be attached to each, with the proper speed marked in red; but where alternators are run in parallel the best way is to have a good speed indicator fixed on the switchboard, or close to it, driven by a small synchronous motor supplied with current from the bus bars through a transformer, and as this motor will always rotate at the same speed as the alternators, and could be coupled direct to the speed indicator, it is a better arrangement than a separate indicator belted to each engine. It is a bad plan to have switches on or near the dynamos, as in case of a machine burning up it might be impossible to get at the switch; and besides, there is the danger of anyone passing the machine accidentally moving the switch. Of course, where the brushes have to be adjusted by hand, directly the machine is switched in, as in the case of the old open-coil arc machines, a switch on the machine does not matter so much—in fact, it is rather an advantage. All rheostats should be placed as near as possible to the switches they belong to, so that the attendant can adjust the resistance and at the same time watch the effect on the ammeter or voltmeter.

In order that the engineer may know the output of the electrical machinery and its behavior at any particular time recording instruments should be used; each feeder or circuit should be provided with a recording wattmeter at the station end; there should be a recording voltmeter connected to the main bus bars, and recording ammeters are very useful on circuits where a constant current is required. These recording instruments are of great use to the engineer; they show him how the plant will respond to a sudden increase of load, and also how the men in charge of the different parts of it attend to their duties, besides indicating the presence of faults in the circuits, etc. The switch attendant should know when he opens or closes a switch how and why the particular result follows, not only that a certain result does follow a certain movement of the switch, and for this reason a large diagram of the electrical connections should be hung on the wall near the switchboard. The diagram might be drawn on a piece of thin sheet-iron painted white, the more important connections being traced with different colored paints; it could thus be easily kept clean and alterations made when required. With a diagram of this description, combined with a card of emergency instructions, there should be little fear of a switch attendant making a mistake.

The engineer in charge of a central station should be provided with an office close to the switchboard and opening into the engine room, in order that he may be at hand if anything goes wrong. He should have a set of standard instruments for testing the ammeters, voltmeters, steam gauges, etc., in the station, besides a set of indicators and gear, thermometers, draught gauge, speed counter, etc., for testing engines and boilers. His office should be connected by telephone with the clerk's office and also with the different sub-stations, if sub-stations are used, if not with one or two call offices in the town in order that the lamp trimmers and men working on the mains may report to him when necessary. Telephones to different parts of the station are of very little use; if the engineer can sound a loud electric gong in the engine room and boiler house he will easily be able to give what few orders he requires by its use. Just outside the office a gauge should be fixed showing the steam pressure in the main steam pipe, another gauge showing the draught in the main flue, and others for vacuum, water pressure, etc., if necessary; these gauges may be recording instruments if it is desired to have a permanent record of the readings.

The steam and water valves are a very important part of the controlling apparatus of a central station, and great care should be exercised in their arrange-

* From the *Electrical Engineer*, London.

ment and use. All valves in the works, down to ½ in. drain valves, should be right-handed ones, as this prevents a great deal of confusion; they should be placed in easily accessible positions (in some stations valves are to be found in every out-of-the-way corner), every one numbered plainly, and in all but perfectly obvious cases they should have brass labels attached showing what they are and what they shut off. All valves ought to be opened and closed and the spindles oiled once a week, and once in six months or oftener the covers should be taken off and the valve seats examined, as it is most important that valves should be tight and at the same time work freely; and yet it is often the case that when a valve has to be closed very quickly, owing to the bursting of a steam or water pipe or something of that kind, it takes all the strength of two men to close it slowly, thus turning what might have been only a slight accident into a serious breakdown. The engineer should have a diagram in his office showing all the steam and water pipes in the works, with the positions of the valves, which should all be numbered to correspond with the actual ones. This will save a lot of trouble when valves require repairing, etc.

Automatic devices are of very little use in a central station; many have been tried and fresh ones are brought out every day, but the general experience seems to be that they cannot be depended upon for long, although they may work perfectly when new, as the action of rust, dust and dirt and wear is not taken sufficiently into account when designing these appliances. Besides this, the use of automatic machinery tends to make the men careless, as they get into the way of trusting too much to it and neglecting precautions which they would otherwise take.

These matters may seem very trivial, but they are really most important to the successful running of a station, and it would pay central station engineers well to spare no pains in order to make the controlling arrangements of their plant so simple that it would be almost impossible for a man to make a mistake even in the greatest hurry. At present the majority of central stations are behindhand in this respect, and what engineer is there who could walk round his plant and if he asked himself, "What would happen if I closed this valve or opened that switch?" could reply without any hesitation in every case? As far as the valves were concerned, he would probably find that he knew nothing about many of them.

AN ELECTRICALLY OPERATED DRAWBRIDGE.*

BY WALTER KIDDE, M. E.

Since February 22d of the present year there has been in successful operation a 450-ton drawbridge over the Passaic River at Newark, N. J. This is the largest electrically operated drawbridge yet constructed, and the consequent necessarily original designs, starting with the fixed requirements of the builders, are interesting.

The problem, as put to the contracting engineers having the installation of the motive power was, that they were to furnish, by means of electrical machinery, power (from a 500 volt direct circuit) which would open or close the bridge in 30 seconds, this power not to be available until the wedges and locking device had been withdrawn, also that the mechanism for operating these wedges and the closing bar be automatically cut off, so that they could not be used until the bridge was closed. Furthermore, a whistle for signaling purposes was to be ever ready for use; while, what is essential, the bridge was to be turned completely around and back and forth as the conditions of navigation required.

These conditions have all been met, and the bridge for the last five months has been successfully handled by three men on their regular trips, who, when they first went into service, knew nothing of electricity and little of machinery.

Two cables are led into the stream from one of the approaches and carried under the bed of the river into the center pier of the draw span. They are brought up through the center pin of the bridge into a contact commutator, all under the roadway. The commutator has two parts, the lower part consisting of a copper ring and a central copper disk on an insulator plate securely fastened to the stationary center bridge pin. Over this and acting as a cover is the part which moves with the draw. It is circular, of a heavy pattern, and has projecting through it on a diameter three copper plugs, also entirely insulated from one another and the iron box. Inside of the box these plugs broaden into shoes, two of which are held by means of springs to the center disk and to the ring of the stationary part respectively, and being constantly in contact with them establish a line and return to the motor room above. The third shoe intermittingly touches the lower ring only at times when the bridge is closed, breaking contact as soon as the bridge moves from this position. This is accomplished by two diametrically opposite cams on the lower insulated block, one of which, depending on the arc the bridge swings through, sets quick acting springs in motion to make or break this secondary circuit. The circuit uses the center plug as one of its poles and drives the motor when operating the wedge shaft.

Following these two circuits they are brought to the switchboard in the motor room with an automatic circuit breaker to properly safeguard the electrical machinery. The switches are usually kept closed as the controller and the switching table only are used in operating the motor.

The assembled machinery of the motor room consists of a motor with its shaft extended so as to carry the several clutches and gears arranged as follows:

First in order, there is the spur of a pair of gears which operates the line shaft for turning the bridge. This spur runs free on the shaft, being brought into action as part of same by means of a friction clutch. The shifter used in connection with this clutch serves also to throw in another smaller one controlling a sprocket wheel and chain to the shaft for the locking device and wedges.

The shifter oscillates between the two clutches as directed by a long operating lever. A motion to the right, besides mechanically gripping the large pulley with its system of gears for turning the bridge, closes the electrical connection corresponding to it on the switching table (in this case the main circuit). Thrown over to the left the lever makes the secondary circuit so that when brought well over it operates the wedge and drawing bar by throwing in the clutch controlling the wedge shaft. When in its central position neither clutch is in use. It is thus impossible to operate both clutches at the same time. The mechanism, which indicates the position of the wedges on a disk, is driven directly from the wedge shaft; it also interposes automatically a latch bar in the arc of the swinging lever. Thus in trying to turn the bridge after having locked it by moving in the wedges, the latch bar will hold the lever in that segment until the wedges have been withdrawn, when the bridge may be opened.

At the extreme end of the extended motor shaft is a sprocket wheel, connecting by means of iron link belting to a triplex, direct-acting air-pump which maintains a pressure of 40 pounds in a suitable air receiver used to operate the whistle for signaling purposes. This pump can be put in operation even while the operating lever is in its central position and all other machinery idle.

The speed of the motor and its direction of rotation is governed by a reversible controller having suitable resistances to control the speed of the motor when driving the different loads due to operating pump, wedges and bridge. The controller is placed near the main operating lever at the switching table so that the operator can manipulate the entire mechanism in one position, where windows have been placed so as to render visible the stream and the movements of vessels.

The drawbridge structure is 720 feet long, while the draw proper is 227 feet in length and 67 feet wide. The total weight of the moving span is 450 tons.

Current for the motor is furnished by a line from the People's Light & Power Company of Newark, whose station is a few hundred yards above the bridge on the river.

It may not be amiss to point out the possibilities in the electrical operation of drawbridges. Over the Harlem River in New York City there are a score of bridges, one close upon the other. They could all be operated and lighted from one central plant with closely regulating high speed automatic engines, radiating power which would precede a ship in its passage through the successive draws.

* From the "Stevens Indicator."

HULL MUNICIPAL ELECTRIC SUPPLY WORKS.*

As announced in our issue of last week, the electric supply works of the Hull Corporation have recently undergone considerable extension, in the opening of a new generating station at Sculcoates-lane. The history of the electric light undertaking in Hull is briefly as follows: In 1887 an electric lighting committee of the Corporation was formed, and on August 4 of the following year an electric lighting order was obtained. Mr. R. E. Crompton was engaged to report on a scheme, and recommended, in 1891, a low-pressure scheme at an estimated cost of £16,000. This was followed by the appointment of Mr. F. Harman Lewis as borough electrical engineer, the Crompton scheme being immediately proceeded with. This scheme included a generating station in Dagger-lane, with engines aggregating 560 HP., direct coupled to Siemens dynamos of 300 kilowatts capacity. The original plant included accumulators of the Crompton-Howell type, and about 2½ miles of mains laid on the Crompton system. On June 16, 1893, these works were opened and have since run continuously with complete success. There were 33 consumers connected at the time of the inauguration and an equivalent of 600 lamps. During this year considerable extensions of mains took place, about three miles of mains on the Callender-Webber system being laid. In the following year the plant at the Dagger-lane station was extended by the installation of a 300 HP. Willans engine and a 180 kilowatt dynamo, and in the next year a similar extension of plant took place.

Owing to the rapidly increasing demand for current, it became necessary, in June, 1896, to consider a scheme for very extensive additions to the electrical supply system, this scheme being estimated to cost £42,000. Unfortunately, it was twice rejected by the Town Council, but in December of the following year Mr. Hammond's report on the scheme was submitted for a third time, and finally accepted by the Council, with the addition of £10,000 to the estimate for the district of East Hull. At this time the number of consumers connected was 520 and the capacity of the plant 26,817 lamps. No less than 340,339 units were sold during the year 1896, a profit of £1,970 being made on the year's working. The new works were pushed on with, but owing to some delay in starting them and to the increased number of applications for current, temporary works had to be laid down in 1897, these commencing supply in conjunction with the Dagger-lane station. The temporary works ran from November 5th until March 5th following, when the capacity of the Dagger-lane station was increased to 1,160 HP. in engines and 660 kilowatts in dynamos. The present capacity

* Abstract from the *Electrician*, London.

of the new station in Sculcoates-lane, together with the sub-stations at Argyle street and Albion street is 760 HP. in engines and 456 kilowatts in dynamos, but there are 750 HP. in engines at present under order together with 450 kilowatts in dynamos. At the present date there are 863 consumers connected to the mains, and lamp connections aggregate 67,900 while no less than 16½ miles of mains have been laid including the 3¼ miles now actually being laid. The customers include a great variety of consumers, there being, in addition to the ordinary lighting consumers, a fairly large motor load for printing and other work. We will now proceed briefly to describe the equipment of the new station and the sub-stations which have been recently erected.

Boiler Room.—In the boiler room there are at present erected two Lancashire boilers, each being 30 ft. in length and 8 ft. in diameter, together with a Babcock-Wilcox boiler of 150 HP. The last named boiler has 1,218 sq. ft. of heating space, composed of six sections, each section having nine tubes 4 in. diameter and 18 ft. long. The headers are made of wrought steel and the drums are 36 in. diameter and 23 ft. 7 in. long. The boilers work at 150 lb. pressure. All the boilers are at present hand fired with the best South Yorkshire steam coal. In conjunction with the boiler plant there is a Green's economizer, composed of 192 tubes, arranged in two groups, coupled together by expansion elbows and tested to 350 lb. pressure. The feed pumps are of the direct-acting vertical type, with the pump underneath. They throw their supply from a tank filled with softened water, a water softener of the Pemberton type being used, together with a clarifying or filtering tank and apparatus for thoroughly mixing the reagent solution with the water to be softened. The feed supply is arranged on the duplicate ring main system, similar to that employed for the steam ranges, and arranged so that any pump can supply any boiler either with cold or hot water. In addition to the feed pumps there is also an independent injector feeding gear, which can be used either in conjunction with the pumps or otherwise. The water for the feed, as well as for the condensing plant, is pumped out of an adjacent drain by means of two centrifugal pumps 5 in. and 7 in. in diameter, and is discharged into a large overhead tank of 29,120 gallons capacity. Each pump is driven independently by an electric motor. From this tank the water is supplied to the two ejector condensers through a 12 in. pipe. The exhaust from the engines can be turned either into the condensers or into an atmosphere pipe of 15 in. diameter which runs along under the floor and is carried upwards outside the building. The steam ring consists of two parallel lines of 8 in. wrought iron solid drawn pipe, with welded flanges resting on cast-iron chairs behind and above the boilers and connected at the ends with copper U bends of the same size as the pipe. Into this ring each boiler feeds by a separate copper pipe bent into an S shape so as to avoid strains due to expansion. The standpipes are each provided with a complete set of valves enabling each boiler to be used independently, an arrangement which is also applied to the engines running off the ring mains. The plane of the ring is inclined downwards towards the boilers and it is drained at two points by steam traps. One 30 B.H.P., and one 14 B.H.P. shunt motor have been erected, coupled to centrifugal pumps for condensing purposes; also one 2 B.H.P. shunt motor for driving the economizer scrapers, all the motors running off the 220 volt circuit.

Machinery Room.—In the machinery room there is erected high and low pressure continuous-current plant, having an aggregate capacity at present of 456 kilowatts. The low-pressure plant consists of two Willans engines of the G. G. S. type, each indicating 100 HP. under 140 lb. steam pressure. These engines run at 450 revolutions, and are coupled direct to two-pole dynamos, each dynamo giving 130 amperes at 300 volts. These machines are for the supply of local consumers, also for the pump and economizer motors on the works. The motor generator is also installed in the building, and is used for balancing purposes or for supplying light loads in conjunction with the battery. The high-pressure plant consists of two Willans engines of the I. I. I. S. type, capable of developing 360 HP. at the same pressure when running at 350 revolutions per minute. These are coupled direct to two-pole dynamos, each giving 90 amperes at 2,250 volts. These generators are separately excited from a 225 volt circuit. The armatures of these machines are wound on the Eickemeyer principle. All the engines are fitted with Messrs. Willans and Robinson's automatic expansion gear and a separate condenser is provided for each engine, the condensers being of the Körting injector pattern, and arrangements are made so that each set can be run either condensing or non-condensing, as required. A 10 ton hand-power traveling crane spans the engine room.

Switchboards.—The switchboard equipment consists of two separate switchboards for the high and low pressure plant respectively. These have been made as nearly as possible fireproof, being composed of 1½ in. slate slabs mounted on iron frameworks. The low-tension board contains two dynamo panels, one battery panel, two feeder panels, one Board of Trade panel, one motor-generator panel, and one works distribution panel. Each dynamo panel is fitted with a Weston ammeter and voltmeter, a D. P. switch with maximum and minimum control, a throw-over main switch and field regulating switches. The battery is placed on one side of the three-wire system and 18 regulating cells are connected to the switchboard. All motors, lights, etc., on the works are connected to throw-over switches on the works distribution panel, so as to enable them to be run from either side of the system. Wattmeters are installed in the low-tension feeders both here and at the sub-stations, so that all current delivered to the distributing mains is metered.

The high-tension switchboard contains two dynamo panels, one Board of Trade panel and six feeder panels, and four spare panels for extensions are provided. Each dynamo panel contains a Weston ammeter, a Kelvin voltmeter, a D. P. switch with maximum and minimum control, and field regulating switches. The dynamos are connected by the D. P. switches to the high-tension 'bus bars, from which the feeders are tapped. The feeder panels each contain a Weston ammeter and voltmeter, a D. P. switch with maximum cut-out, and transformer starting and regulating switches. The voltmeters on the feeder panels are connected to the feeding points on the low-tension mains, and the pilot wires are connected to them via the shunt coil of a long range switch on each transformer. By short-circuiting the voltmeter about 5 amperes is made to pass through this coil, and the long range switch is actuated, connecting a transformer to that particular feeding point. A repetition of the process throws the switch into the "off" position.

Battery Room.—The battery room at the main station contains 126 Pritchett and Gold 11-plate cells in glass boxes. The capacity of this battery is 300 ampere-hours at 225 volts.

Sub-Stations.—There are at present 2 sub-stations, one at Albion street and one at Argyle street. The building at Albion street was specially designed for the purpose, and contains two 90 kilowatt rotatory transformers and a motor generator. Room for an extension of the plant is provided. At Argyle street four railway arches have been utilized, two of which are used as stores for the outdoor department, one as a battery room and one as a transformer chamber. In the battery arch there are 240 Pritchett and Gold cells similar to those at the generating works. These are charged in three sets of 80 cells off the distributing mains, and are discharged in two sets of 120 cells. The switchboard is situated in the transformer arch, where there are two 90 kilowatt and two 45 kilowatt machines with the necessary switches, etc. The 90 kilowatt transformers are wound for a step-down from 2,250 to 450 volts. The 90 kilowatt transformers at Albion street supply a portion of the old network and are wound for 2,250 to 225 volts, the motor generator forming a connecting link between the old 220 volt three-wire and the new 440 volt three-wire networks. The transformer armatures are provided with high and low tension winding on the same core and with a commutator at each end. They are "Eickemeyer" wound, with an earthed metallic shield between high and low tension windings. The lubrication is effected by a force pump on each bearing, and the machines can be run for long periods without attention.

Mains.—The mains extensions consist of six high-tension circuits running from the generating station in Sculcoates-lane to the two sub-stations and low-tension feeders running from the generating station and these sub-stations to various points in an extensive network of distributing mains. The high-tension feeders, pilot and telephone wires are drawn into stoneware conduits. These conduits are made in 3 ft. lengths, and are jointed together by means of stoneware cradles with Portland cement; no less than 45,000 yards of 2¼ in. by 2¼ in. duct has been used, spare ways being provided for future extensions. Draw-boxes built of 9 in. brickwork on concrete foundations are provided at all corners and bends and where otherwise necessary, and they are provided with cast-iron frames and covers and are ventilated by means of a stoneware pipe connected to a small ventilator frame. The high-tension feeders (of which about 17,000 yards have been laid) are 0.06 sq. in. and 0.03 sq. in. sectional area, concentric, insulated with impregnated fibrous material, lead-covered and externally taped and compounded. The low-tension feeders consist of about 4,600 yards of 0.5 sq. in. concentric lead-covered cable, armored with two layers of 0.05 in. hoop-iron and laid direct in the ground. Three 9 and 12 core pilot wires are laid alongside the feeders, and a four conductor "dry-core" (air space) telephone cable permits of communication between the generating and sub stations.

About 24,000 yards of distributors have been laid of the triple core, impregnated fiber insulated lead-covered and armored type, the positive and negative conductors being of 0.15 sq. in. section. The advantages of this class of distributing main for three-wire systems are now universally recognized. It combines flexibility with facility of jointing, the service and other boxes employed being of a much simpler construction than those for triple concentric mains.

All the cables, before and after laying, have been subjected to exhaustive tests with satisfactory results. The straight joints are made in cast-iron boxes in two halves bolted together. The internal fittings consist of copper sleeves and sockets for sweating the conductors into, and are embedded in the hard-setting insulating compound with which the boxes are filled. About 60 disconnecting boxes, both of three-way and four-way patterns, have been inserted in the network, and allow of any section of the distributor being rapidly cut out or disconnected for testing purposes. The internal fittings of these boxes are so arranged that either disconnecting copper links or fuses can be used. They are set in brick pits, with manhole frames and covers of similar construction to the draw boxes. The service cables are of the twin pattern, india-rubber insulated, lead-covered and armored, and are connected to the mains through cast-iron T boxes.

Measuring Line Losses.

Mr. F. Lecomte, says the *Electrical Engineer*, London, describes in *L'Electricien* a method of accurately ascertaining the fall of potential in a line or circuit in which there is frequent alteration in pressure.

This method consists in having two voltmeters, one at each end of the line. The circuit is then interrupted at the generator end. The voltage is read at that end at the time of break, and the observer at the further end of the line takes the interruption as a signal to record the reading on his voltmeter. The method is simple, but the necessary interruption is the faulty part of the idea.

TELEGRAPHS AND TELEPHONES IN PERSIA.*

The first telegraph line in Persia was established about thirty-six years ago, and in the beginning was vigorously denounced and opposed by the priests as being a species of magic and closely allied to other evil principles greatly subversive of religion and the best interests of the State, and as such not to be permitted to have a place in the economy of government. This opposition, however, was overcome and the class which resisted so stoutly at the first now use the telegraph with the greatest indifference. In the year 1862 the construction of a telegraph line from India to England through Persia, Russia and Germany was commenced, and it began working on January 1, 1870. Some work had, however, been carried on for three or four years by a line through the Euphrates Valley; but according to the United States Vice-Consul at Teheran, this was not by any means of a satisfactory character, and serious errors, delays and interruptions occurred. This line is still used occasionally.

The Indo-European is a well constructed and efficiently managed line. From Bushire to Karachi there is both a cable and a land line. This line provides the local native administration with one wire which can always be depended upon. The local lines, with the exception of the one wire mentioned above, are the property of the Persian Government. The ownership was acquired by the cost of construction, and has been maintained by defraying the expenses of preservation. The actual administration is deputed to one man, who, until very recently, contributed to the Government $12,000 a year. This royalty has now been raised to $30,000 a year. The yearly receipts of the telegraphs have been about $60,000, and the expenditure equals, if not exceeds, the income. In consequence, certain reforms are to be initiated in the direction of compulsory payments. It is stated that fully 50 per cent. of the telegrams are sent free. Officials of the Government (central and local), priests, expounders of the law, relatives of persons connected with the working and the administration, and everyone who can provide himself with a reason or excuse, send their telegrams free of expense. As this system has been growing for many years past, and most of those who have been benefited by it are in a position to give trouble, the management find it difficult to introduce changes necessary for their own protection.

The Persian local system comprises about 3,100 miles of wire and 86 offices for the receipt and despatch of messages. The wire provided by the Indo-European administration, gratis, is about 1,300 miles long, and extends from the Persian Gulf to the Russian frontier. Stamps are not used for any purposes in Persia except for letters. Messages are restricted to 10 words, at a charge of 2½ krans (about 18 cents). The actual charge for the message is 2 krans, and the half kran is for the paper on which it is written. In case the message extends to a large number of words it is calculated at the rate of 10 words to the 2 krans, and not 2½ krans. This tariff is the same for any distance in Persia; there is only one charge. The Persian newspapers rarely contain information of sufficient importance to be sent by telegraph, consequently there is no press rate, and, indeed, there are very few press messages.

There are four newspapers in Persia, printed in the vernacular, and under Government control. These should be issued once a fortnight, but they are often issued at longer intervals; they are in no sense considered as leaders or exponents of the ideas or feelings of the people. As regards telephones the late Nasredin Shah, on December 8, 1889, granted to the then Minister of Foreign Affairs a concession for electric lighting, the introduction of telephones, phonographs and the application of electricity to industrial purposes to the whole of Persia, with protection to the monopoly for the period of 60 years. This concession was transferred to an American citizen for a certain valuable consideration, but for want of means the purposes of the concession have not been put into execution. In order to protect the concession from lapsing, two or three wires were put up and kept in a workable state, and are now in use.

Five years ago the railway and tramway company commenced erecting private wires for anyone who would undertake the expense, and they established an exchange office on their own premises at Teheran. It has not been extended to any other town. So far no records have been kept of the number of miles of wire erected, but the Vice Consul says that from his observation he should estimate it at about 50 miles—this is including the wires into villages of summer resort, and those to different parts of the city. At the present time there are 15 owners of private wires, each of whom pays the company about $2.12 per month for keeping the wires in repair and the instruments in order. The receipts about balance the expenditure, but this only includes the free use of the lines by the company, who provide the only office there is in the city and two in the country during the summer months. As messages are not received from the public no tariff has been formulated. Subscribers are put into communication and use the telephones as long as they wish. As a more extended use of the telephone would interfere with the receipts of the telegraphs, permission to use it has not been granted to distances appropriated by the telegraphs.

* *Society of Art Journal.*

Motor Car Trials in Paris.

In the competition of motor-cars for heavy loads, which took place in Paris from October 6th to 12th, the electrically propelled cars did not gain any distinction. Of the four electric cars competing, only one went through all the six journeys prescribed as tests. These journeys were, however, of such a nature as to be particularly trying to electrical automobiles, being on three routes—26, 29 and 41 miles long respectively—with one minute's rest after each kilometer traversed. It is intended, according to the *Engineer*, to choose a special route for the electric cars next year, to fulfil as much as possible the conditions of town and suburban goods transport. The Jenatzy van of the Compagnie Général des Transports Automobiles is of the same system as the cab which took part in the recent Paris trials, except that it has no change-speed gear. The gross weight was 4,500 kg., including 1,500 kg. of dead weight and four passengers. The batteries of Fulmen accumulators weigh 1,200 kg. and the inventor claims that with these the van can run 120 km. With a discharge of 28 to 30 amperes the vehicle ran 12 to 13 km. an hour on the level, and on the up grades the discharge was 70 amperes and the speed 7 km. an hour. The average voltage was 82. The van accomplished all six routes without incident.

The Société des Electromobiles presented a van upon the Bersey system with a battery of Fulmen accumulators. It completed five out of six journeys. The Krieger van was not ready before Monday, so that it was only able to cover the three routes once. As with nearly all the French electric cars, the energy was stored in batteries of Fulmen accumulators. The weight of the vehicle was 2,500 kg., including 600 kg. of dead weight. On the A route the average rate of discharge was 24 amperes at 85 and 86 volts, and the consumption was 6 kilowatt hours. The carriage work of the Mildé Mondos van is, says our contemporary, of the highest class description, and is fitted with a duplex motor, the power being transmitted by chain from a very small pinion on the countershaft to the rear driving wheel. There were two batteries, one containing Mildé accumulators and the other Fulmen; moreover, one of the batteries was old and the other new. To make matters worse, the accumulators polarized through bad charging, and for most of the time the van was in the tent undergoing repairs.

The only time it finished a route it was followed by a portable engine with a dynamo, and this precaution was a wise one, for the batteries had to be re-charged on the road to enable the van to return to Versailles. The greatest interest was taken in the trials by delegates from local bodies all over the country, and the Minister of War ordered a large number of officers to follow them with a view to ascertaining whether motor cars could be profitably employed for military purposes.

Trolley Sickness.

Trolley sickness, says the New York *Sun*, is causing great distress in the northern suburbs and in parts of Brooklyn. As is well known, young children are usually exempt from seasickness, but they enjoy no such immunity in the matter of trolley sickness. On the contrary, they are peculiarly the victims of this new disease. As infants play around in careless glee on shipboard, while their wretched elders are lost to the world in their bunks below, bent in abject misery over the rail or stretched limp and listless upon blanketed steamer chairs, so on the trolley cars, while grown folks swing merrily from the overhead straps, or bawl the latest gossip into one another's ears, the poor little victims of trolley sickness writhe in tortures and wail in unison.

In the case of trolley sickness, as in that of sea sickness, fresh air is often the best remedy, and so it happened that so long as open cars were run upon the suburban trolley lines infant misery was kept within reasonable bounds. But now that the advance of the season has brought out the closed cars, the sickness daily increases. It must be remembered, too, that in the case of trolley sickness there is no such convenient rushing to the rail as in the case of sudden seizure on shipboard. To be sure, most unhappy looking infant faces are daily seen protruding from the windows of the trolley cars, but this convenient resource is seldom available, since trolley cars are so densely crowded much of the time that to get a child suddenly upon the seat and its head out of the window is almost impossible. Mothers of foresight encourage their children to stand on the seats and look out of the windows, so as to be in the very best possible position for any sudden emergency.

But when a trolley car is packed, as Brooklyn and suburban trolley cars sometimes are packed, and as horse cars never were packed, because no two horses could ever have drawn such loads, the position of the infant suddenly seized with trolley sickness is truly pitiable. So, too, is that of the mother, for she receives, instead of sympathy, the angry looks of her fellow passengers, who would flee her and hers as a pestilence, but who, struggle as they may and tread down and elbow one another as they will, cannot put more than six inches between themselves and the object of their disgust.

In Brooklyn, where the art of trolley-car riding has been brought to a higher degree of perfection than elsewhere, save in Philadelphia, there is a rumor that the trolley parlor cars at least are to have a corps of chambermaids. This provision, the managers of the trolley lines hope, will promote general comfort. Meanwhile there is a widespread demand throughout all the territory threaded by the Huckleberry lines for a remedy that will at least assuage the violence of trolley sickness, and a disposition among the childless to demand that the discrimination against children practised in some apartment and boarding houses be extended to the trolley cars.

EXPORTS OF ELECTRICAL MATERIAL FROM THE PORT OF NEW YORK.

The following are exports of electrical material from the port of New York for the week ending November 7:

Antwerp—4 cases electrical material, $2,821; 10 packages electrical machinery, $600.

Africa—3 cases electrical material, $457.

Argentine Republic—114 cases electrical material, $5,957; 30 cases electrical machinery, $2,781; 1 case electros, $2.

Brazil—2 cases electrical material, $110.

British Possessions in Africa—4 cases electrical material, $146.

Bremen—8 cases electrical material, $500.

British Guiana—8 packages electrical material, $359.

British West Indies—186 cases electrical material, $16,867.

Cork—4 cases electrical machinery, $166.

Cuba—44 cases electrical material, $1,159.

Central America—16 cases electrical material, $285.

Chili—15 cases electrical material, $189.

Dutch West Indies—3 cases electrical material, $37.

Dresden—2 packages electrical material, $27.

Ecuador—6 cases electrical material, $125.

Glasgow—8 packages electrical material, $856; 4 cases electrical machinery, $123.

Hong Kong—11 cases electrical material, $714.

Japan—2 electric motors, $79).

London—184 cases electrical material, $7,200; 21 cases electrical machinery, $1,560; 1 case electros, $117.

Liverpool—12 packages electrical machinery, $220; 12 cases electrical material $291.

Mexico—17 cases electrical material, $792; 5 cases electrical material, $50.

Newfoundland—6 packages electrical material, $58.

Nova Scotia—1 package electrical material, $24.

Newcastle—16 packages electrical material, $25.

Odessa—29 cases electrical material, $916.

Peru—21 cases electrical material, $387; 3 cases electrical machinery, $400.

Porto Rico—60 packages electrical material, $1,304.

Rotterdam—1 case electrical machinery, $300.

Siam—27 packages electrical material, $700.

Santo Domingo—8 cases electrical material, $75.

Southampton—8 cases electrical material, $628.

Uruguay—1 case electrical machinery, $739; 8 cases electrical material, $202.

U. S. Colombia—44 packages electrical material, $1,134; 8 cases electrical machinery, $704.

Venezuela—2 packages electrical material, $27; 7 cases electrical material, $80.

A Treasury Ruling on the Exportation of Incandescent Lamps.

On a question concerning the exportation of incandescent lamps, the following decision has been promulgated by the Treasury Department at Washington:

"On the exportation of incandescent electric lamps, manufactured by the Edison General Electric Company of Schenectady, N. Y., in part from imported glass bulbs and tubing, a drawback will be allowed equal in amount to the duty on such imported materials used in the manufacture, less the legal deduction of 1 per cent. The entry under which the merchandise is to be inspected and laden must show the marks and numbers of the shipping packages, and the number of lamps in each package, describing the bulbs used as they are described in the import invoice. The drawback entry must show the number of lamps of each kind or description exported, and must further show, in addition to the usual averments, that the said lamps were manufactured and packed for shipment in the manner set forth in the manufacturer's sworn statement, dated May 25, 1898, filed with the Collector of Customs at New York. In the liquidation of entries, 1,000 glass bulbs and 5 pounds of glass tubing shall be taken as bases of allowance of drawback for each 1,000 lamps exported. Samples may be taken, as ordered, by the collector, for such official examination as may be deemed necessary."

LEGAL NOTES.

The Seneca Electric Light and Power Company, embracing the plants at Seneca Falls and Waterloo, N. Y., has been placed in the hands of H. H. Crowell of Syracuse as receiver. The action was brought by the Old Colony Trust Company of Boston as trustee of the company's bonds.

The Colfax Electric Railway at Denver, Col., is to be sold by order of the court, on petition of George E. Ross-Lewin, the trustee. The face value of the bonds is $150,000, but the interest brings the indebtedness up to $216,000.

At New Orleans on the 3d inst., Warren B. Reed and Brainard Rorison, complainants in the case of Warren B. Reed et al. vs. Edison Electric Light Company, amended their original bill for a restraining order as follows: "That Warren B. Reed was the original and first inventor of the new and useful improvement for electric motors patented June 4, 1894, and the invention was not known or used by others here prior to his original invention, nor had it been used in this country for more than two years prior to his application for letters patent; and that Warren B. Reed and Edward Rorison are the sole owners of said invention and letters patent and of all rights and claims thereunder."

The Appellate Division has affirmed the judgment of the Supreme Court awarding $7,500 damages to Rose Flaherty for injuries resulting from shock from a fallen trolley wire of the Nassau Electric Railway Company at East New York and Rockaway avenues, Brooklyn, N. Y., on October 10, 1896.

The ruling of Judge Comstock in a recent street railway suit at Terre Haute, Ind., was as follows: "1. A street car company is not liable for damages caused by a horse taking fright at one of its cars when running along the street in the usual and ordinary manner, unless the motorman knew that the horse would become unmanageable if the car were not stopped and wantonly continued on his way, and it is shown that the accident could have been averted had he stopped the car after he had reason to believe danger from the fright of the horse was imminent. 2. A motorman who sees the driver of a horse dismount and hold the horse by its bridle as his car approaches may reasonably infer that such driver can control the horse while the street car passes. 3. The liability of a company for accidents of this kind arises only from unusual and improper running of cars or from conduct evincing a wanton disregard of the safety of persons known to be in peril."

CANADIAN NOTES.

A by-law to provide $6,000 for the purchase of an electric light plant for the town of Acton, Ont., has received the sanction of the ratepayers. Arrangements will be made immediately for the installation of the plant.

In the city of Halifax, Nova Scotia, a special committee has been obtaining information as to the advisability of the city undertaking its own street lighting and as a result the city electrician and engineer have been instructed to prepare plans and invite tenders for a suitable plant.

The most startling offer for the supply of electric power yet made in the city of Toronto was among the tenders received by the Board of Control of that city this week. A company has put in a tender to light the city streets and supply energy for manufacturing purposes at the rate of 1 cent per horse-power per hour. Their capital, they state, will be $5,000,000, and when their dividends reach 10 per cent. they offer to light the streets at cost price. They will also establish a manufactory for electric supplies and the profits of this will come under the same agreement.

Within another year Quebec, it is said, will be one of the best lighted cities in the world. It will have no less than three companies converting water powers in the vicinity into electricity. They will be the Montmorency Falls Company, the Chaudiere Company, now in course of formation, and the Jacques Cartier Water Power Company, which has already commenced to build at the falls of Jacques Cartier river in Valcartier, some 18 miles from the city of Quebec. This company will also build large pulp and paper mills at the falls.

The official announcement has been made by the Quebec, Montmorency & Charlevoix Electric Railway Company that it is proposed to electrify the road running to Cape Tourmente, Que., and to construct an independent branch to Montmorency Falls. The estimated cost of improvements is given as $330,000, and when completed the system will comprise over sixty miles of electric railway. The president of the company is H. J. Beemer.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING.

Camden, N. J.—The council has granted a franchise to the Citizens' Light, Heat & Power Company. The new company will bid on the street lighting contract as a competitor of the Camden Lighting & Heating Company, which has had a monopoly in the lighting business for several years.

Carthage, Mo.—The city council has passed an ordinance authorizing a special election on the 22d inst. to get a vote on the proposition to issue $25,000 in bonds to build and equip an electric lighting plant for public and private purposes. It is expected that the bond issue will carry. When built, the plant will include arc and incandescent lights.

Grand Rapids, Mich.—There is lively competition among the makers of lamps to see which company shall get the contract for furnishing the arc lamps for the new electric lighting system. The Adams-Bagnall lamp is named in the contract, but the Chase Construction Company, which is to install the plant, has agreed to furnish whichever lamp the board of public works decides upon.

Green Bay, Wis.—The Green Bay Gas & Electric Light Company and the Fox River Lighting Company have consolidated and the new concern will submit bids for the city lighting. The city is given the option of buying the consolidated plant within a certain time at the inventory price of the plants.

Grand Forks, N. D.—The East Side city council have decided upon municipal ownership of waterworks and an electric light plant. The recorder has been instructed to advertise for bids to be opened December 1. The plans and specifications submitted by W. J. Gray & Co., of Minneapolis, were adopted.

Iowa City, Ia.—The committee appointed by council to investigate the probable cost of erecting and maintaining an electric lighting plant in this city have made their report, in which after presenting the results of their investigations they think it advisable for the city, rather than build a plant, to enter into a five years' contract with the local electric lighting company at the rate of $70 per arc light per annum.

Lonaconing, Md.—The agitation for another electric light plant for this town continues, and if arrangements cannot be made with the parties putting in an ice plant here to combine a lighting plant with it, an independent lighting plant will be established.

Park City, Utah.—The Ontario Silver Mining Company, R. C. Chambers superintendent, has been granted a 25-year franchise to operate an electric plant in this city and to furnish light, heat and power by electricity to the public.

Savannah, Ga.—An ordinance has been introduced in the city council which is to give the Edison Electric Illuminating Company the use of the streets for the purpose of constructing an overhead and underground electric system to supply light and power.

Seattle, Wash.—Bids for city lighting were opened on the 1st inst. The bids were as follows: Union Electric Company—Arc lights, each, per month, $8 80; 15 candle-power, incandescents, each, per month, $1.32; 30 candle-power, each, per month, $1 95. Consumers' Electric Company—Arc lights, $9; 15 candle power incandescents, $1.40; 30 candle-power, $2.10, and for additional lights, arc, $8.75; 15 candle-power, $1.30; 30 candle-power, $1.90. The Seattle Gas & Electric Company offered to put in 100 sixty candle-power Welsbach lights at $2 per month. The Snoqualmie Falls Power Company offered to furnish arc lights in the First, Fourth, Fifth and Sixth wards, as now distributed, at $7 per month. All bids were referred to the secretary of the board for classification and comparison.

Talladega, Ala.—Two of our prominent business men will put in an electric lighting plant here if satisfactory arrangements can be made with the city authorities.

Trenton, N. J.—It has been officially announced that the controlling stock of the Trenton Light & Power Company is to be transferred shortly to Col. A. R. Kuser and Thomas C. Barr of Newark. It is also said that the shareholders of common or preferred stock are to have the opportunity of selling their interest at the same figures secured by James Moses, from whom the control was purchased. The "Gazette" says that those who are in a position to know say the move means that

the Delaware River Improvement Company is to come into Trenton, and that operations towards permanently establishing that corporation in this section are soon to be begun.

Watervliet, N. Y.—Preparations are being made to illuminate the public buildings with incandescent electric lights. At present the police station, corporation hall, chamberlain's office, office of the board of education and the several houses of the fire department are lighted with gas. It is expected the places mentioned will use the incandescent system of illumination before the close of the present year.

STREET RAILWAYS.

Bethlehem, Pa.—The formal opening of the Easton, Palmer & Bethlehem Electric Railway took place on the 10th inst. The ceremony was attended by the city officials of Easton, the borough officials of the Bethlehems, officials of the Allentown Traction and the Easton Transit Companies, a number of Boston capitalists and about twenty-five newspaper men. After a ride over the whole system a banquet was held at the American House in this city, where covers were laid for 100. The new railway is twelve miles long and connects the Bethlehems, Butztown, Farmersville and Altonah with the county capital. There is now a continuous electric railway from Easton to Siegfried's, a distance of thirty miles.

El Paso, Tex.—The city council has granted to a citizens committee the franchise for an electric street railway on the principal streets and for electric lights. The committee will transfer the franchise to capitalists who will establish the railway system.

Hagerstown, Md.—The directors of the Blue Ridge Electric Railway Company have selected a committee of prominent business men and experts to decide upon a route for the electric railway over the Blue Ridge Mountains. It is stated that the plan most likely to be adopted will connect Penmar and Blue Mountain House and then swing over to Blue Ridge Summit, Monterey, Buena Vista and back again to Penmar. From the latter point a line will extend to Waynesboro, Pa., and other points in the Cumberland Valley. It may also be extended to Gettysburg. The company is composed of Pennsylvania and Maryland capitalists.

Lexington, Va.—John R. Williams, a prominent business man of Richmond and owner of a large hotel in the western suburbs of Lexington, is considering the feasibility of building an electric road to the hotel, and has had an engineer examining the ground for the best route.

Lynchburg, Va.—The situation of affairs in Lynchburg in regard to street railroads is somewhat remarkable. About a month ago the city council granted a new franchise to the Lynchburg Electric Railway & Light Company, and gave them the right to extend their line into a new and large section of the city which has heretofore, to a great extent, been one of the chief contributors to the Rivermont Street Railway Company. Later the council granted the Rivermont Street Railway Company the right to extend a branch line from down town out to the city park, which will split the territory of the Lynchburg Electric Railway Company directly in two. When the two lines, as proposed, are completed, Lynchburg will have as complete a street-car system as any city of similar size in the country. The Rivermont line is operated by Lynchburg capital, while the other line is owned by New Yorkers.

Madison, Ind.—It is reported here that Benj. Johnson, the engineer who built the Madison street electric railway, has been engaged by Enoch H. Fudge and other Chicago capitalists to examine into the feasibility of constructing an electric railway from Lexington, on the Baltimore & Ohio Railroad, through Hanover and Madison to Vevay, a distance of forty miles.

Middleboro, Mass.—Articles of association have been formed for another street railway to connect the New Bedford, Middleboro & Brockton line, through Lakeville and East Taunton, with Taunton. It will be known as the Taunton & Middleboro Street Railway Company, with a capital stock of \$55,000. The route selected will lessen the distance from New Bedford to Taunton about four miles, while increasing the distance from Middleboro about two miles. The Taunton & Middleboro road will open up the lake country of the towns of Middleboro and Lakeville.

Neenah, Wis.—The Fox River Valley Interurban Electric Railway is completed and the first car went over the line a few days ago. The continuation of the road to Oshkosh is likely to cause another fight, the route being in dispute.

Newport News, Va.—The Peninsula Railway Company proposes to build an electric road connecting this city with Hampton and has applied to the councils of both places for a franchise. The company was chartered by the last Legislature.

Rome, N. Y.—The highway commissioner has granted right of way over the highway from Oriskany to Rome to the Utica Suburban Railway Company. The company will endeavor to get a franchise within the city limits.

Willimantic, Conn.—The Willimantic Street Railway Company has been organized under an arrangement made between Jesse W. Starr, representing a syndicate, and the original incorporators, for the purchase of the franchise which confers the right to the streets of Willimantic for the operation of a trolley railway. Mr. Starr agrees to put the engineers at work at once.

MANUFACTURING, ETC.

Cleveland, O.—Superintendent Charles A. Boyd, of the Walker Manufacturing Company, is reported in the "Cleveland Press" as saying: "Electricity will completely supplant steam as a motive power in less than ten years. We are to-day building electrical power devices that two years ago were not conceived. If the knowledge of electricity and new methods of using this mysterious power advances in the next decade as it has done in the last, steam locomotives and factories operated by steam power will be curiosities."

Harrison, N. J.—The General Electric Company have taken steps toward the erection of a much larger building on the site of their old lamp factory in this town. The new building will be 63 feet wide, and will have a floor space of 60,480 square feet. The contracts are about to be awarded and the cost of the building will be about \$75,000. The structure is to be finished by April 1, 1899. The output of the present works is said to be 40,000 incandescent lamps a day. The capacity of the new works will, it is estimated, be 50,000 a day.

Washington, D. C.—Consul Lyon writes to the State Department from Hiogo, Japan, that he has received a letter from the president of the Kobe Electric Light Company at that port, in answer to the consul's inquiries relative to electric light supplies. The company, the letter states, formerly used only the Edison lamp, but in 1894 changed to English and German lamps, in consequence of their being cheaper; but it recognizes the superiority of the American or Edison lamp, and says that as it is desirable to use lamps requiring the least amount of power, machinery for testing lamps is now being put up, which when done may disclose that it should discard the cheaper English and German lamps, and again use the Edison. The prices are given as follows: Lamps of 5, 8, 10, 16 and 24 candles, 32 sen (16 cents) apiece; 32 and 50 candles, 50 sen (25 cents), this being the cost on delivery at Kobe.

TRANSMISSION PLANTS.

Idaho Springs, Col.—A. R. Specht of Boston, who has built a concentrating mill at Dumont, is contemplating the erection of a big electrical power plant at that place to be run by the waters of Clear Creek, which are to be stored in two reservoirs, one to be constructed just below Lawson and the other between the town of Empire and the railroad. Wires will be run to most of the mines in that section and electric machinery of all kinds, including electric drills, will be installed.

Portland, Ore.—The water power of the Sandy River is to be utilized for transmission electrically to Portland and other points if surveyors who have been looking over the ground make a favorable report to Eastern capitalists who are said to be interested in the scheme. The Sandy is a very crooked stream of water, and is about 40 miles long. It drains one of the slopes of Mount Hood, and it has a habit of becoming a torrent at times, when its usual volume is tenfold larger than ordinary. Then it is that the water goes foaming and roaring to the Columbia, sweeping aside all obstacles. It will be a great engineering feat to build a dam to control the water when it becomes a torrent.

Toronto, Can.—The Ontario Government takes the view that the Niagara Power Company has forfeited its charter because of its failure to develop 10,000 horse power by the 1st of November, and will ask the courts for a decision on the question. The company's legal adviser says, as reported in the "Mail-Empire" "that \$100,000 had been spent on plant at Niagara Falls. Enough power had been developed to supply any reasonable demand eight times over, but there had been no call for it from local industries. The company had a demand for 8,000 horse-power from Toronto, and was perfectly willing to transmit to that city or anywhere else, if a few months' delay was granted. The great difficulty had been that there were no means by which power of any considerable quantity could be transmitted for a distance of 50 miles. That obstacle had now been overcome, and the company was now able and willing to transmit 10,000 horse-power if desired."

Victoria, B. C.—The Cascade Water, Power & Light Company now has an engineer upon the ground at Cascade City, preparatory to building a dam and developing the magnificent power at that place. Mr. Anderson, who superintended the construction and development of the Bonnington Falls power, has full charge of construction. It is contemplated putting in dam, flumes, etc., this winter, ready for the machinery, which will be put in place in the early spring.

COMPANY MATTERS.

Lowville, N. Y.—The Wetmore Company, which is building a transmission plant at Belfort, on Beaver River, has purchased the Lowville Electric Light & Power Company's interests.

Philadelphia.—The American Electric Meter Company, incorporated under the laws of New Jersey, has made an assignment for the benefit of creditors to William D. Marks, president of the company.

MINES, ETC.

Las Vegas, N. M.—An electric light plant is being put in place at the Confidence mine in the Mogollon district, and the machinery will hereafter be run and the mine lighted by electricity. One hundred and fifty men are employed.

PERSONAL AND MISCELLANEA.

A daily paper states that Col. John Jacob Astor has applied for a patent for an electric railway motor of his invention which he hopes soon to be able to test practically.

Sherman Gates, of Wichita, Kan., has been sent by a New York firm to Perth, Australia, to superintend "the electric mechanical construction of mining courts," and the Wichita "Beacon" states that he will be gone four years, with a splendid salary and all expenses paid.

The municipality of Paris has recognized the value of electro-therapeutics by adding a new wing to the hospital at La Saltpetriere, which will be devoted exclusively to the treatment of diseases by means of electricity in its various forms. While charlatans and quacks by their ignorant use of electricity have brought electro-therapy into disrepute, there is now a growing tendency among the medical profession to acknowledge that electricity has a well-defined place in the curative art.

"A few years ago," says the Hartford (Conn.) "Times," "the New London Street Railway Company inaugurated the plan of appealing to the employes to use all possible care in running the cars and all civility in the treatment of passengers, and in return offered the civility on its own part of a share in the profits, provided the employes responded to the suggestion. The plan has worked apparently to the satisfaction of all concerned. The road has just sent out notices to each of its employes that a certain sum of money has been placed to his credit in a savings bank on account of this extra compensation. This circular also expresses the thanks of the company for the services rendered, speaks of the 'faithful and intelligent performance of duty' by the men and mentions the advantage to the road, its patrons and its employes that attends giving the best service possible. We have not seen any mention of the amount of profits thus shared, but it is evidently enough to be worth some little additional care, and it certainly seems to smooth relations between the parties to the agreement. In the city of Norwich, sixteen miles away, it is proposed to inaugurate the same system before long, perhaps as early as next January."

Dispatches received in Chicago from San Francisco announce the death there on the night of the 2d inst. of C. H. Summers, chief electrician of the Western Union Telegraph Company. He was suddenly seized with heart failure and died in a few minutes after the attack. Mr. Summers entered the telegraph service in 1854 as an operator on the old Pittsburg, Cincinnati & Louisville telegraph lines, of which James D. Reid was superintendent. After this line was consolidated with the Western Union Telegraph Company he worked at different points as an operator, and in 1859 while working at Indianapolis was offered and accepted a good position on the railroad lines. Indianapolis was his headquarters until 1867, when he was made superintendent of telegraph of the Indianapolis, Cincinnati & Lafayette Railroad telegraph lines and located at Cincinnati. In 1869 he was called to Chicago as chief electrician of the western division of the Western Union Telegraph Company by Gen. Anson Stager. He had been in the service of this company as electrician ever since that time.

RECENT COMPANY ELECTIONS.

Haverhill, Georgetown and Danvers Street Railway Company, Haverhill, Mass.—President, Charles E. Barnes; treasurer, James F. Shaw; assistant treasurer, George A. Butman; clerk and counsel, Edmund B. Fuller; directors: Charles E. Barnes and John F. Hall of Plymouth, F. E. Lowe of Greenfield, James F. Shaw of Newburyport, George A. Butman of Malden, Arthur D. Veasey and Herbert B. Newton of Haverhill.

Merchantville Light, Heat & Power Company, Merchantville, N. J.—Directors: F. A. Downes, F. J. Burr, W. H. McCallum, George P. Williams, F. C. Robbins and William M. Griffith.

Montreal Street Railway Company, Montreal, Can.—Directors (all re-elected): L. J. Forget, James Ross, R. B. Angus, K. W. Blackwell, F. C. Henshaw.

West Philadelphia Passenger Railway Company, Philadelphia, Pa.—President, George D. Widener; secretary and treasurer, Alexander Renwick; directors: P. A. B. Widener, William L. Elkins, Joseph E. Gillingham, Geo. D. Widener, Thomas Dolan, James McManes, Joseph B. Altemus, Thomas J. Yarrow and George W. Elkins.

COMMERCIAL PARAGRAPH.

The Fostoria Incandescent Lamp Company of Fostoria, Ohio, announces that it has opened an Eastern office in the White Building, 95-97 Liberty street, New York City. This will also be the Eastern office of the Orouse-Tremaine Carbon Company.

INCORPORATIONS.

The Caro Light & Power Company, Caro, Mich. Capital stock, \$25,000.

The Rocky Ford Electric Light Company, Pueblo, Col. Capital stock, \$15,000.

The United Traction Company, Chicago. Capital stock, \$500,000. Incorporators: Albert E. Wilson, Anson E. Meanon and Louis J. Boham.

The Pacific Trading Company, Tacoma, Wash.—to conduct a general wholesale and retail brokerage and commission business, to erect and run factories, build and operate telegraph and telephone lines, electric light and

power plants, etc. Capital stock, $5,000. Incorporators: J. W. Garvin, F. H. Chandler and C. McDaniels.

The Harper's Ferry Electric Light & Power Company, Harper's Ferry, Va. Capital stock, $15,000. Attorney, D. B. Gibson, Charlestown, W. Va.

The Jackson County Electric Railway Company, Kansas City, Mo. Capital stock, $70,000. Incorporators: F. W. Sears, Annie G. Lightner, J. J. Hoover and others.

The El Porte Zuelo Light & Power Company, Chicago. Capital stock, $500,000. Incorporators: Chester T. Crandall, William M. Carpenter and William B. Patterson.

The Sawyer Manufacturing Company, Camden, N. J.—to manufacture gas and electric fixtures, etc. Capital stock, $50,000. Incorporators: H. H. Sawyer and H. S. Sawyer, Ridley Park, Pa.; Albert Bumm, Camden, N. J.; George L. Rowland, Philadelphia, Pa.

The Mitchell Pearson Electric Company, Portland, Me.—to manufacture and sell electric car appliances. Capital stock, $150,000, of which $25 is paid in. President, George A. Copeland, Revere, Mass.; treasurer, William E. Pearson, Winthrop, Mass.

ELECTRICAL PATENT RECORD.

Letters Patent Issued November 8, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

613,708. Electric Railway. James F. McLaughlin, Philadelphia, Pa. Filed May 2, 1896.

613,713. Trolley-Pole Guide-Rope. Samuel R. Parks, Central Falls, R. I. Filed Aug. 4, 1897.

613,744. Mechanism for Holding Trolleys to Their Wires. William R. Weaver, Covington, Ky., assignor of two-thirds to George L. Weaver and Harry D. Weaver, same place, and James C. Brown, Franklin, O. Filed Oct. 9, 1897.

613,794. Electric Railway. William M. Brown, Johnstown, Pa., assignor to the Johnson Company, Lorain, Ohio. Filed Jan. 22, 1898.

613,691. Life-Saving Apparatus for Street-Cars. Hosea W. Libbey, Boston, Mass. Filed Jan. 24, 1898.

613,719. Combined Car Brake and Fender. Harry J. Raisch, San Francisco, Cal., assignor to Barton Josephus Parker and George X. Wendling, same place. Filed April 13, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

613,838. Cap for Enclosed Arc-Lamps. Chas. E. Harthan, Lynn, Mass., assignor to the General Electric Company of New York. Filed April 23, 1898.

613,841. Phosphorescent Electric Lighting. Daniel M. Moore, Newark, N. J., assignor to the Moore Electrical Company, New York City. Filed Dec. 17, 1896.

613,918. Electric-Lighting System for Vehicles. Rufus N. Chamberlain and Albert S. Hubbard, Belleville, N. J. Filed Feb. 17, 1898.

613,955. Flash-Light Apparatus. Simon D. Alter and Lewis T. Young, Philadelphia, Pa. Filed March 12, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

613,669. Brush-Holder. Albert E. Doman, Elbridge, N. Y., assignor to the Elbridge Electrical Manufacturing Company, same place. Filed Feb. 4, 1898.

613,663. Connector. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Aug. 5, 1898.

613,648. Electric Switch. Fredrick A. La Roche, New York City. Filed Dec. 28, 1897.

613,692. Governor for Air-Compressors. Sam H. Libby and William B. Potter, Schenectady, N. Y., assignors to the General Electric Company of New York. Filed March 6, 1897.

613,735. Electric-Circuit Controller. Nikola Tesla, New York City. Filed April 19, 1898.

613,809. Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles. Nikola Tesla, New York City. Filed July 1, 1898.

613,851. Electric Regulator. William H. Chapman, Portland, Me., assignor to the Belknap Motor Company, same place. Filed March 21, 1898.

613,869. Controlling Device for Electric Motors. Frank J. Russell, New York City, assignor of one-half to Horace See, same place. Filed May 25, 1898.

613,840. Generating and Distributing Electric Energy. Charles M. Green, Cleveland, O., assignor to the General Electric Company of New York. Filed April 18, 1895.

613,881, 613,882. Generating and Distributing Electric Energy. Charles M. Green, Cleveland, O., assignor to the General Electric Company of New York. Filed Dec. 23, 1896.

613,894. Dynamo and Electric Motor for Driving Vehicles. John B. Sherrin, Ramsgate, England, assignor to the Britannia Motor Carriage Company, Limited, London, England. Filed Aug. 17, 1895.

614,025. Brush-Holder for Dynamo-Electric Machines. George L. Pratt, Atlanta, Ga. Filed June 2, 1898.

MISCELLANEOUS.

613,705. Electric Timing Race Apparatus. John I. McDonald, St. Joseph, Mo. Filed Jan. 4, 1897.

613,778. Indicator Signal. Parnell Rabbidge, Sydney, New South Wales. Filed Feb. 1, 1897.

613,877. Alarm. Charles A. Deal, Chicago, Ill. Filed July 29, 1897.

613,899. Instrument for Measuring Electric Currents. Earl C. Eldredge, Springfield, Mass. Filed June 20, 1898.

614,012. Primary Battery. Carl Koenig, Berlin, Germany. Filed Feb. 16, 1898.

DESIGN.

29,632. Cylinder-Cap for Arc-Lamps. Charles E. Harthan, Lynn, Mass., assignor to the General Electric Company of New York. Filed April 23, 1898.

TELEPHONE AND TELEGRAPH.

New Telephone Association.

The Kentucky Telephone Association was organized at Crab Orchard, Ky., on the 2d inst. with the following officers: President, A. H. Bastin, Crab Orchard; vice-presidents, J. S. Vanwinkle, Danville; E. T. Fish, Berea; and A. D. Shotwell, Somerset; secretary, James Maret, Mt. Vernon; treasurer, F. P. Cambest. The object of the association is the improvement and extension of the independent telephone service in Kentucky and for the mutual benefit and protection of its members. Nearly all Kentucky companies were represented at the meeting, and it is promised that a great improvement and many extensions will be had at an early date.

The Sioux City, Ia., *Times* says: "A contract has just been closed by the Home Telephone Company of Sioux City and the Independent Telephone Company of Des Moines, with Pierce, Waterbury & McAllister, of Mason City, for the construction of a metallic circuit line from Sioux City to Des Moines. Preliminary work on the line will be commenced at once and it is to be completed and in operation by September 1, 1899 The line, through the Des Moines exchange, will give Sioux City connection with the independent lines to the east and southeast and with the Haneman independent lines to the southwest as far as Topeka, Kan. It also will afford Des Moines and these east, southeast and southwest independent lines connection through the Sioux City exchange with northern Nebraska, the Dakotas and Minnesota. The proposed line will be independent of any lines now built or in process of building. It will be distinctly a Sioux City-Des Moines line.

Mutual Telephone interests were represented recently at a meeting in Des Moines, Ia. Among the lines represented at the meeting were the Mutual Company of Des Moines, by J. W. Hill; the Southwestern Telephone Company and Clearfield and Mt. Ayr Company, by D. M. Smith; the Perry Telephone Company, by G. M. Bandy; the Jefferson Telephone Company and the Boone-Marshalltown Company, by C. E. Wells, and the Central Telephone line by W. Brandt. Statements were made that before spring every town of any importance within 100 miles of Des Moines would be connected with that city. A line will also be run to St. Joseph. Oskaloosa and Ottumwa will be reached and also Ft. Dodge, Sioux City, Marshalltown, Boone and many other places. The companies in the Iowa Telephone Association now have lines reaching 184 towns. The Southwestern is talking of a line to Omaha and Council Bluffs.

The People's Mutual Telephone Company of San Francisco has filed a petition with the Supervisors requesting that it be granted a year's extension of time in which to comply with the condition of its franchise requiring that $100,000 must be expended during the first year thereof. The company explains that, owing to litigation, it has not been justified in proceeding with the work of constructing its system. It is represented that after a decision of the Supreme Court had been rendered in favor of the company, contracts were thereafter entered into for materials and supplies of an aggregate value of $176,500 and that preparations are now being made for the commencement of work that will cost $200,000. For these reasons it is submitted that the company is entitled to an extension of time.

The Kansas City (Mo.) *World* states that O. T. Spellman, an attorney, has asked Judge Slover of the Circuit Court for a writ of mandamus against the Missouri & Kansas Telephone Company to compel the company to furnish him the use of a telephone at one-half its present rate. The suit is brought under a section of the revised city ordinances of 1898 relating to telephones, which is similar to that decided illegal by Judge Wofford of the Criminal Court in 1895, with the provisions he held invalid left out. The present ordinance was enacted by the Kansas City council in 1897. It provides that telephones in the business district shall cost their users but $3 a month or $36 a year instead of twice that amount. Judge Slover has not yet passed upon the application.

A number of the most substantial business men and bankers in Wichita, Kan., are said to have perfected plans to incorporate a company for the purpose of building an entirely new telephone system in that city as a rival of the Missouri & Kansas Company. It is the intention of the company to place telephones in the business houses and offices at a price not to exceed $1 50 a month, and $1.25 a month in residences. A petition for a franchise has been drawn up to be presented to the city council at its next regular meeting.

The reasonable use of the streets of a city for the equipment of a telephone system, including poles and wires, is held, in Magee vs. Overshiner (Indiana) to be a lawful use, and not a new and additional servitude for which the abutting owner can claim compensation.

A Wireless Telephone.

The following item, which we find in an exchange, may give some suggestions to the gentlemen who are endeavoring to find some practical method of telegraphing without wires:

"A recent traveler among the Indians of Catuquinaru, in the Amazon region, between the rivers Embyria and Embyrasu, says they employ a wireless telephone. It is made by digging a hole in the ground inside the house and laying the bottom with coarse sand well piled. On this is laid a wooden drum, or hollow cylinder of wood, half-filled with fine sand and layers of broken wood, bone and powdered mica. The upper part of the cylinder, which is empty, rises above the floor of the hut, and is closed by leather, then wood and lastly india-rubber. Outside the cylinder is packed round with fragments of wood, leather and rosins, which is covered with hard rubber at the level of the soil. To use the apparatus the drum is struck by a wooden hammer, and the vibration is evidently transmitted through the soil. The answer is heard in the drum, which acts as a resonance chamber. Messages can thus be sent over 1,500 yards from house to house."

A meeting of the owners of three independent long-distance telephone lines of Southwestern Missouri and Southeastern Kansas was held at Fort Scott on the 2d inst. Action was taken toward a consolidation of the lines. This will make a system in strong competition with the Bell Telephone Company. The Union Telephone Company declared a 5 per cent. quarterly dividend and decided to extend its lines south from Moran and Iola to several county seat towns. At Girard it is proposed to connect with the line which encircles the mining towns of Missouri and Kansas.

The Hanamo Telephone Company is meeting with opposition in its endeavor to get a franchise to South St. Joseph. The Citizens' Company of St. Joseph is opposing it in the first place, and is opposing it strenuously. The reason is a matter of revenue entirely. The Hanamo is connected with up country points through the Citizens' central office in St. Joseph. It gets considerable stock-yards business. It demanded a lesser exchange rate from the Citizens' Company. This was refused. The outside company then decided to build its own line to South St. Joseph and applied for the franchise.

L'Illustration of Paris, remarking on the number of telephones in service in the United States, deplores the lack of readiness to employ these instruments in Europe. In Berlin, where there are 30,000 in use, the average number of calls is not more than seven a day—two in the morning and three or four in the afternoon. Among the European countries, Germany and England hold the lead, with 140,000 and 116,000 instruments, respectively. In France there are scarcely more than 35,000, while there are 62,000 in Sweden and 30,000 in Switzerland.

A despatch from New Haven, Conn., states that representatives of a syndicate have been canvassing Connecticut for the past few days with the idea of organizing telephone exchanges. The Southern New England Telephone Company is now in undisputed control of the situation. It is said that the new enterprise is sufficiently backed to offer a strong opposition to the old concern. Plans are on foot to establish telephone exchanges all over the State, and to apply to the next session of the General Assembly for articles of incorporation.

At Marietta, Ga., it has become a permanent business of the telephone company to serve subscribers with sermons transmitted over the wires. The Christian Endeavor Society of the Presbyterian Church in Marietta has had a telephone put in their church for the benefit of a member who has been confined to his room with rheumatism for ten years. It has proved a great source of comfort to him and his friends.

The Midland Telephone Company has completed its line connecting Adrian, Minn., with Ellsworth and St. Kilion. Arrangements are pending for a joint rate to be established with the Bell long-distance line, which will allow the local system's patrons to talk over the whole Bell system.

New Companies Incorporated.

The Green County Telephone Company, Greensburg, Ky. Capital stock, $3,500.

The Montpelier Telephone Company, Montpelier, O.—to maintain toll lines between villages in Williams and Fulton counties, Ohio. Capital stock, $15,000.

The Ohio Telephone Company, Columbus, O.—to operate a telephone system throughout the State of Ohio. Capital stock, $100,000. Directors: R. E. Jones, T. A. Simons, David C. Beggs, F. D. Simons, Howard Park, L. D. Myers and William C. Orr.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Nov 14:						
Albany Ry. Co.	100	2,000,000	$1,750,000	1¾ % Q., Aug. '98.	151	158
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Aug, 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Nov 14:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	....	..	15
Bridgeport. Conn—Nov 14:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Nov 14:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '98	73	..
aBaltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	2 % S., July 15, '98	25½	25⅝
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec, 1897.	...	..
Boston, Mass.—Nov 14:						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	13¼	13¾
North Shore Traction Co. com	100	4,000,000	4,000,000	....	10	12
North Shore Traction Co. pfd	100	2,000,000	2,000,000	6 % S., A. & O.	73	77
b West End Street Ry. Co. com	50	10,000,000	9,085,000	3½ % S., Oct., '98.	88	88½
West End Street Ry. Co. 8 % pfd	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	109½	...
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	78½	79
Brooklyn N. Y.—Nov 14:						
Brooklyn City & Newtown Ry.	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	215	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	6½	68¾
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR. guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	282	284
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR.	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	230	..
Kings County Elevated	....	4,750,000	4,750,000	....	2¾	4
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad pfd.	......	6,000,000	6,000,000	....	70	..
fAtlantic Avenue Railroad	50	2,100,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo. N. Y.—Nov 14:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	....	62	66
*Buffalo Railway Co.	100	6,000,000	5,870,500	1 % Q. Dec., '97.	78	79
Columbus O.—Nov 14.						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Aug., '98.	56	57
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Nov 14:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '98.	..	..
Enterprise City RR. Co.	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Nov 14:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q.	290	299
Chicago & South Side R. T. RR.	100	10,828,800	10,828,800	....	..	..
Lake Street Elevated RR.	100	10,000,000	10,000,000	....	10	11½
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk.	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR.	100	10,000,000	6,600,000	3 % Q., Oct., 98.	..	230
hNorth Chicago City RR.	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co.	100	20,000,000	18,189,000	1½ % Q., Oct. 98	96½	99
jChicago West Div. Ry. guar.	...	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry. guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Nov 14:						
Cincinnati Inc. Plane Ry. com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc Plane Ry. pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	29¾	80
lCincinnati Street Ry. Co.	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118⅛	118¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Nov 14:						
Akron, Bed. & Clev. Elec. Ry.	100	1,000,000	1,000,000	¾ % Jan., '98	89	41
Cleveland City Ry.	100	8,000,000	7,600,000	¾ %., Oct., '98.	70	75
Cleveland Electric Ry.	100	12,000,000	12,000,000	¾ % Q., Oct., '98	78½	79½
Detroit, Mich.—Nov 14:						
Detroit Citizens' Street Ry.	100	2,000,000	1,250,000	....	100⅛	..
Ft. Wayne & Belle Isle Ry.	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co.	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry.	100	250,000	200,000	....	100	110
Dayton O.—Nov 14:						
City Railway Co. com.	100	1,500,000	1,470,600	1¼ % Q., Jan. 1, '98.	105	..
City Railway Co. pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway	....	1,100,000	....	....	102	103

* Unlisted. † Ex div.
a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
b Leased to Boston Elevated Railroad Company.
c Owned by Brooklyn Rapid Transit Company.
d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.
e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR
g Owned by Atlantic Ave. RR. and leased to Nassau system.
h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,101 of stock owned by North Chicago Street Railroad Company.
i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $626,100 of stock owned by West Chicago Street Railroad Company.
k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.
l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked
Hartford Conn.—Nov 14:						
Hartford Street Ry. Co.	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	—
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	—
Holyoke Mass.—Nov 14:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	185	200
Hoboken, N. J.—Nov 14:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	103	—
Indianapolis, Ind—Nov 14:						
**Citizens' Passenger Ry.	...	5,000,000	5,000,000	....	24	25
Lancaster, Pa.—Nov 14:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000	....	..	—
Lancaster & Col. Electric Ry.	....	... ...	87,500	....	..	—
West End Street Railway	...	....	....	....	..	—
Louisville, Ky.—Nov 14:						
Louisville Ry. com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	85	40
Louisville Ry. pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	101	103
Minneapolis, Minn.—Nov 14:						
Twin City Rapid Transit com.	100	17,000,000	15,010,000	....	27	29
Twin City Rapid Transit 7 % pfd.	..	3,000,000	1,714,200	1¾ % Jan., '98.	151	108
Montreal, Canada.—Nov 14:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	8 % S., M. & N.	279	280
Toronto Street Ry. Co.	100	6,000,000	6,000,000	1¾ % S., J. & J.	105	10¾
Memphis, Tenn.—Nov 14:						
Memphis Street Railway Co.	100	500,000	500,000	....	15	—
New Haven, Conn.—Nov 14:						
Fair Haven & Westville RR.	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co.	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	—
Winchester Avenue RR.	25	1,000,000	600,000	....	40	..
New Orleans, La.—Nov 14:						
Canal & Claiborne RR. Co.	40	240,000	240,000	4 % S., Jan., '98.	151	200
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co. com.	100	5,000,000	5,000,000	....	1⅛	1½
New Orleans Traction Co. pfd.	100	2,500,000	2,500,000	....	8¼	9
aCrescent City RR. guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	6½	82
bNew Or. City & Lake RR. guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	28½	35
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	5.⅞	52¼
New York—Nov 14:						
Central Crosstown RR.	100	600,000	600,000	2½ % Q.	75	..
cChristopher & 10th Sts. RR. guar.	100	650,000	650,000	2 % Q., July, '98.	60	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug, 98	80	198
dMetropolitan Street Ry. Co.	100	30,000,000	30,000,000	1¾ % Q., O.t., 98	18½	19¼
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	8⅛	..
fBroadway & Seventh Ave. guar.	100	2,100,000	2,100,000	2½ % Q.	15	227
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	80	188
hEighth Avenue RR.	100	1,000,000	1,000,000	......	60	410
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	370
jNinth Avenue RR. guar.	100	800,000	800,000	....	18	190
kSixth Avenue RR. guar	100	2,000,000	2,000,000	....	200	210
lTwenty-third St. R. R. Co. guar.	100	600,000	600,000	4½ % Q.	35	70
Second Avenue RR.	100	2,500,000	1,862,000	2 % Q. July, '98.	200	210
Third Avenue RR.	100	12,000,000	10,000,000	$2 p. sh. Aug. 18.	171	172
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	69	78
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	190
Newark N J.—Nov 14:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	50	51
Newark Passenger Ry.	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry.	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Nov 14:						
Allegheny Traction Co.	50	500,000	500,000	....	49	50
oConsolidated Traction Co. com.	50	15,000,000	15,000,000	2 %, Jan., '96.	2⅞	21
Consolidated Traction Co. pfd.	50	15,000,000	15,000,000	3 %, May, '97.	56⅛	56¼
pCentral Traction Co.	50	1,500,000	‖900,000	....		...
qCitizens' Traction Co.	50	3,000,000	‡3,000,000	6 % A.	..	...
rDuquesne Traction Co.	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co.	50	2,500,000	1,900,000	3 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	25	..
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	‖2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	25	25½
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co. com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co.	50	800,000	200,000	....	..	..

* Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.
a Leased to New Orleans Traction Company at 6 % on stock.
b Leased to New Orleans Traction Company at 8 % on stock.
c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.
d Operating the former Met. Trac. system, that corporation having become extinct.
e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.
i Leased to Metropolitan Street Railway for 18 % on stock.
j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
k Leased to Metropolitan Street Railway for $145,000 per annum.
l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
m Controlled by Third Avenue Railroad by purchase.
n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.
o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co
p Leased to Consolidated Traction Company for 8 % per annum on par value of stock
q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.
r Leased to Consolidated Traction Company for 6 % on capital stock after October.
s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass–Nov 14						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass–Nov 14:						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.–Nov 14.						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.–Nov 14:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.–Nov 14:						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	68	70
Philadelphia.–Nov 14:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‡1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	538,900	‡538,900	3 % S—July, '98.	67	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	66	..
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450	....	20⅞	21
bElectric Traction Co	50	....	8,297,920	....		...
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	320	..
eFrankford & Southwark Pas. R	50	....	‡1,875,000	$14 sha'e A—Apr.98	400	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	265	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '95.	...	..
gGermantown Passenger Ry	50	1,500,000	‡572,800	$5.25 share—1898.	184½	186
gGreen & Coates Passenger Ry.	50	500,000	‡150,000	3 % Jan., 1898.	135	..
hPeople's Passenger Ry....com	25	1,500,000	‡740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‡277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‡20,000,000	$2 p sh., Oct. 98.	93	93½
jCatherine & Bainbridge St	50	....	‡400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‡580,000	$6 share—July, '98.	140	145
jEmpire Passenger Ry. Co	50	600,000	‡600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‡475,000	$7.50 share July '98	170	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90	..
jRidge Avenue Passenger Ry	50	750,000	‡420,000	$12 share, July '98.	485	800
jPhiladelphia & Darby Ry.guar.	50	....	‡200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‡250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‡335,000	$11 sh. A., July, '98	2 0	..
jUnion Passenger Ry. Co	50	1,500,000	‡900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‡750,000	$10 share, July '98	225	250
Rochester, N. Y.–Nov 14:						
Rochester Railway Co	100	5,000,000	5,000,000	....	14	19
Reading, Pa.–Nov 14						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.–Nov 14:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct., '98.	189	140
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	1 %, Oct., '98.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % Oct., '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry..........com.	50	500,000	500,000	....	57½	59½
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	114	116
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	51	52
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.–Nov.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	108	109
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	50¾	51
Presidio & Ferries RR	100	1,000,000	550,000	....	8½	..
Scranton, Pa–Nov 14:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.–Nov 14:						
Springfield Consolidated Ry	100	750,000	750,000	....	....	..
Springfield O.–Nov 14:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	..
Springfield, Mass.–Nov 14:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	200	205
Toronto Canada.–Nov 14:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	105	10 ¼
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	2.9	280
Washington, D. C.–Nov 14:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	78¾	79
Columbia Ry. Co	50	400,000	400,000	6 % A.	60	75
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	11	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	126	127
Worcester, Mass.–Nov 14:						
*Worcester Traction Co.......com.	100	8,000,000	8,000,000	....	11	18
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	8 % S., Feb., '98.	95	98
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.–Nov 14:						
Wilkesbarre & Wyoming Val. Trac	100	5,000,000	5,000,000	1 %, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
f Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
k Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m **Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.**

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.–Nov 14						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., Oct., '98.	28?	28¼
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug '98.	74¾	75½
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	136½	..
New York.–Nov 14:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	97	98
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	107	109
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	180	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	70
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	74¾	75½
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	110	..
*International Ocean Tel Co.guar 6%	100	8,000,000	......	1½ % Q.	109	..
Mexican Telephone Co	100	2,000,000	......		..	.?0
*New York & New Jersey Tel. Co	100	5,000,000	3,728,000	1½ % Q., July, '98.	151	158
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	92	..
†Commercial Union Telegraph Co	25	500,000	500,000	8 % S., July, '98.	110	118
Western Union Telegraph Co	..	......	97,870,000	1¼ %, Oct., '98.	93¾	94
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.–Nov 14:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	172	178
Chesapeake & Potomac Telep. Co	100	......	......	....	51	...
Chicago Telephone Co	100	......	......	......	235	210
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	182½	134
Empire & Bay States Telegraph Co.	...	......	......	....	72	.8
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	7?	76
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	112	118
Providence (R. I.) Teleph. Co	50	....	......	....	89½	..
Southern New Eng. Teleph. Co	100	8,000,000	......	..	121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.–Nov 14:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec Series A.	25	......	......	....	...	..
†General Electric Co. [old] com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new] "	100	18,276,000	18,276,000	......	82	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2¾	¼
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	...	84¼	85½
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	57½	58
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.–Nov 14:						
Edison Elec. Ill'g Co., New York	100	9,188,000	7,988,000	....	147	150
*Edison Elec Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '98.	..	..
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	28	30
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.		...
General Electric Co [new] ... "	100	18,276,000	18,276,000	......	82	82½
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.–Nov 14:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	165	175
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.–Nov 14:						
Edison Electric Light Co	100	2,000,000	......	......	144¼	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	4 ⅜	49¾
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	5?¾	58½
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co....pfd.	50	5,000,000	......	6 %, Oct., '97.	.	..
Northern Elec. Light & Power Co	10	6,500,000	550,000	$82500 dis. Jan.11'97	13¾	14
Southern Elec. Light & Power Co	10	187,500	187,500	....	16	..
Miscellaneous.–Nov 14:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	40	..
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	18
Eddy Electric Mfg. Co	25	......	......	....	—	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	125	..
Hartford (Conn.) Lt. & Power Co	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	177	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,00	......	? % Q., Oct., '98.	?4	..
Rhode Island Elec. Protec. Co	100	......	......	....	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2 % Q	150	168
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,00	1¾ % Q	187½	188
Thomson-Houston Welding Co	100	......	......	? % S, Dec. 1, '96.	.	100
Woonsocket (R. I.) Electric Co	100	......	......		100	..

†On Aug 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,00 of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.–Nov 14:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1.'98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	92	100
New York.–Nov 14:						
Consolidated Electric Storage Co	...	......	....	....	9½	16
Edison European	..	......	....	......	..	...
Safety Car Heating & Lighting Co	100	......	....	......	10	1?4
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	84	87
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	97	100
Philadelphia, Pa.–Nov 14:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	..	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	14	15
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	6?	61
Welsbach Light Co	5	525,100	......	....	?¾	41¼
Welsbach Light Co., Canada	5	500,000	......	....	..	2½
Pittsburg, Pa.–Nov 14:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	117	119
Miscellaneous.–Nov 14:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	..	15
*Barney & Smith Car Co ....pfd.	100	......	2,500,000	2 %	55	60
Billings & Spencer Co	25	......	....	....	80	86
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	82	35½
Johns-Pratt Co	100	......	....	....	90	100
*Pratt & Whitney Co..........com.	100	......	....	....	1½	8
*Pratt & Whitney Co...........pfd	100	......	....	....	45	50
Stillwell-Bierce Co............com.	..	......	....	....	..	...
Stillwell-Bierce Co..............pfd.	..	.....	......	2 % Sept. 1, '97.	95	98
Shults Belting Co	100	500,000	......	....	83	87
St. Charles Car Co	—	......	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Nov 14, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..........1st mtg. 5s.	....	$29,000	1905	....		....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*112½	....
†The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*111	....
†Watervliet Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*119½	....
†Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*115	....
Troy City Railway Co.................1st 5s	....	....	......	......	*106½	......

†Interest guar. by Albany Ry. Co.
‡Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Nov 14, 1898

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115¼	117
Baltimore Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115½	116
Baltimore Trac. Co..Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	103	101
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1912	J. & D.	116	1 7
†Bal. Trac Co Coll. Trust. 1st mtg. g. 5s	750,000	....	19 0	J. & J.	102	103
†Baltimore Traction Co. Convertible 5s.	800,000	....	19 6	N. & M.	103½	
Central Pass. Ry. Co...........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
†Central Pass. Ry. Co..Cons. mtg. g. 5s	601,000	580,000	1932	M. & N.	117	119
City & Suburban Ry.......1st mtg. g. 5	3,000,000	3,000,000	1922	J. & D.	115	115¾
Lake Roland Elev.,............1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113½
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	120

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Nov 14. 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	103	105
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M.& N.	105	105¼
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation Nov 14 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.. .....1st mtg. 5s.	500,000	47,000	1906	J. & J.	.. .	
†Charleston City Ry ......1st mtg. 6s.	850,000	....	....	J. & J.	....	..

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Nov 14, 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry..........1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102	102¼
‡Chicago Passenger Ry.....1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
‡Chicago & So. Side R T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	.....	....
Chicago & So. Side R. T..........4½s	1,500,000	750,000	1907	J. & J.	....	....
‡Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	105¼	....
Lake Street Elevated RR..1st mtg. g. 5s.	7,571,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	62½	......
North Chicago St. RR........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¼	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	......	......
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	101¼	..
North Chicago City Ry.......consol 4½s.	2,500,000	2,500,000	1927	M. & N.	104¾	107
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	107¼	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	101	......
West Chicago St. RR.....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	95	......
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 ds. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Nov 14, 1898

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	103¾	106
*Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	108	....
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	....	118½
§So. Cov. & Cin. St. Ry.........2d mtg. 6s.	400,000	400,000	1932	J. & J.	.....	185

†Assumed by the Cincin. St. Ry. Co.
§$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Nov 14 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	105¼	106
Cin. New't & Cov. St. Ry..Cons. mtg. 5s	3,000,000	2,500,000	1922	J. & J.	105¾	106
Cleveland City Cable Ry....1st. mtg. 5s	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s	3,500,000	1,249,000	1918	M. & S.	105	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	....	....
aEast Cleveland RR.........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102½	108½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s	600,000	....	1922	M. & N.	....	..
Lorain (O.) Street Ry.........1st mtg. 6s	200,000	200,000	1915	J. & J.	....	....
‡St. Ry. Co..Grand Rapids...1st mtg. 5s	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked a.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Nov 14 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,885,000	1905	A. & O.	97½	98½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	
The Detroit Ry.........1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Nov 14 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	108	......
New Haven (Edgewood Div.) 1st mtg. 5s	250,000	250,000	1914	J. & D.	107	......
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	108	......
Winchester Avenue RR...Deben. g. 6	100,000	94,50[illegible]	1908	M. & S.	100	......

*With interest. *Unlisted.

New Orleans La.

Date of Quotation—Nov 14, 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR............1st mtg. 6s.	......	50,000	1899	M. & N.	101	83½
Crescent City RR.......Cons. mtg. 5s.	5,000,000	3,000,000	1943	J. & J.	83	....
New Orleans City RR........1st mtg. 6s.	416,500	899,000	1903	J. & D.	....	104½
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	104	....
N. Orleans & Carrollton RR.2d mtg. g. 6s.	850,000	850,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	....	....
‡St. Charles St. RR. Co.......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	105	......

†$428,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Nov 14, 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	....
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	8,000,000	1,966,000	1931	A. & O.	110	111
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	1 2½	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave.........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	116	1 9
Broadway Surface..........2d mtg. 5s.	1,000,000	1,000,000	1905	......	106	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	117
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,100,000	448,000	1933	J. & J.	84	93
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	101	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	110	112
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	101⅞	1 8
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	104⅛	104¾
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	.....	103	1 5
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111	1 8
Central Crosstown RR.. .....1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	1 0
Coney Island & Brooklyn RR. 1st mtg. 5s	800,000	800,000	1903	J. & J.	108	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	116	116½
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	102
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	104	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,209,000	1910	M. & S.	116	118
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	99	101
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	122¼	....
Metropolitan St Ry Co..g. m. cl. tr. g 5s	12,500,000	1 ,500 000	1997	F. & A.	11 ¼	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600 000	1909	M. & N.	1 5	115¾
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	109	110
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500 000	1922	J. & J.	114	115½
South Ferry RR. Co..........1st mtg. 5s.	350,000	350 000	1919	......	110	114
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	125	......
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	108	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	118	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1948	J. & J.	111	112½

†$1,085,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Nov 14 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.....................1st mtg. 5s	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Nov 14. 1898

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	189[illegible]	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	...	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210		1948	......	105½	105¾
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,800,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry..............1st mtg. 5s.	500,000	500,000	1911	A. & O	....	....
§Union Traction Co.................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s	....	......	1906	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s	750,000	750,000	1926	M. & N.	116	116½

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Nov 14 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	......	......
Central Traction Co...............1st mtg. 5s.	875,000	875,000	193[illegible]	J. & J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	115	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	......	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1918	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	194[illegible]	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750 000	1928	M. & N.	......	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	....	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	10 ¼	. ..
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	.	110½
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	111	......
Second Ave. Traction Co.....................5s	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Nov 14, 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	108½	109½

St. Louis.

Date of Quotation—Nov 14. 1898.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	108
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co............1st mtg. 6s	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	[illegible]	[illegible]	1913	J. & J.	111½	112½

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis. *Date of Quotation*—Nov 14 1898.						
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co......................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co.............1st mtg. 6s.	400,000	300,000	1910	A. & O.	101	103
People's RR. Co......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co......................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	102½	103½
St. Louis & Sub. Ry................Income 5s.	800,000	800,000	.....	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	112	113
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	114½	115½
†Controlled by St. Louis RR. Co. ‡Controlled by Union Depot RR. Co. ¶Controlled by Lindell RR. Co. ‖$200,000 in escrow to retire 1st & 2d mtg. §$600,000 in escrow. ††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal. *Date of Quotation*—Nov, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	115½	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	114½	......
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	....	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	128½	129
†Metropolitan Ry. Co.................1st mtg.	200,000	....	.....	....	....	......
†Omnibus Cable Co..............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126	......
†Park & Cliff House RR.......1st mtg. 6s.	350,000	350,000	1912	J. & J.	106½	108½
†Park & Ocean RR................1st mtg. 6s.	250,000	250 000	1914	J. & J.	112	......
†Powell St. Ry......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	128
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C. *Date of Quotation*—Nov 14, 1898.						
Belt Ry. Co. ....C[illegible] mtg 5s.	500,000	450,000	1920	J. & J.	51	....
Columbia Ry...................[illegible] mtg. 6s.	500,000	500,000	1914	A. & O.	118	125
Eckington & Soldiers' Home, mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	128	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous. *Date of Quotation*—Nov 14. 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,688,000	1928	J. & J.	101	106
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	112½	114
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	110¾	111
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	108	105
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	109¾	109¾
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	102	102½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	116	117
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	96	100
††No. Hudson Co. Ry. (N.J.).Cons. mtg. 5s	3,000,000	2,378,000	1928	J. & J.	104	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	99	101
St. Paul City Ry....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	......	......
St. Paul City Ry......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	......	....
†$1,000,000 in escrow to retire 1st and 2d mtg. bds. ‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co. ¶$760,000 in escrow to retire bonds of C. C. St. RR. Co. ‖$87,000 in treasury. §$960,000 res'ved to redeem prior liens. ††$620,000 in escrow.						*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass. *Date of Quotation*—Nov 14. 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	10.⅛	....
Pittsburg, Pa *Date of Quotation*—Nov 14, 1898						
Allegheny County Light Co..............6s	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Nov 14, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	110⅛	115
Edison El. Illg. Co. (N. Y.) con. m. g. 5s	15,000,000	2,188,000	1993	......	11[illegible]	......
Edison Elec. Illg. Co. (Brooklyn)........	2,500,000	1,500,000	1940	....	110	115
Edison Electric Light (Philadelphia)..	2 000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)..............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......		......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation*—Nov 14 1898.						
American Bell Telephone....................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co..................7s.	....	......	......	......	....	......
N. Y. & N.J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation*—Nov 14 1898.						
American Electric Heating............5s.	500,000	500,000	...	....	.15	.19
Armington & Sims Eng. Co....................	....	....	......	......	......	25
Barney & Smith Car Co.....................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co.........................6s	....	....	1904	M. & S.	[illegible]	[illegible]
Worthington Pump Co..........................	[illegible]	......	......	......	......	....
Unlisted †Nominal.						

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12⅝c.; Lake, 12¾@13c.; casting, 12½@12⅝c.

The Petersburg (Va.) Street Electric Railway was sold on the 10th inst. under foreclosure to its bondholders for $55,000.

The North Hudson Light & Power Company has filed a mortgage of $2,000,000 to the New Jersey Title Guarantee & Trust Company as trustee.

The trustees of the Street Railway & Illuminating Properties, Boston, have declared a distribution of $2 per share on the common stock, payable November 16. Books reopen November 16.

The United Traction Company of Pittsburg reports for the year ended June 30, 1898: Gross earnings, $1,469,907; operating expenses, $682,916; net earnings, $786,991; interest, rental, taxes, etc., $586,512; surplus, $200,479.

A meeting of the stockholders of the Southern Electric Light & Power Company of Philadelphia will be held in that city on the 23d inst. for the purpose of voting on the question of increasing the capital stock from $400,000 to $2,000,000.

The United Electric Securities Company, Boston, will receive proposals until 12 M. November 16 for the sale to the company of so many of its collateral trust 5 per cent. bonds of the fifth, sixth and ninth series as will be absorbed by $69,478.28.

At the annual meeting of the stockholders of the Manhattan Railway Company held in New York last week, no news regarding the projected equipment with trolley was given, and the meeting adjourned after re-electing the board of directors and receiving the annual report.

The directors of the Metropolitan Cable system of Kansas City, Mo., are contemplating an increase in its dividend rate from 2 to 4 per cent. Messrs. Ream and Armour of Chicago own about $700,000 of the stock, and Robert Fleming of Scotland about $800,000. Nearly $1,500,000 of the stock is owned by the Colling-Merriam interests.

There is a probability that something official will be announced this week in regard to the purchase of the Nassau road by the controlling interests of the Rapid Transit Company of Brooklyn. There have been many conflicting statements about the deal within the last three weeks, but we have it from good authority that no conclusive arrangement has yet been reached.

Bernard F. Gallagher has been elected president of the Edison Electric Illuminating Company of Brooklyn, N. Y., in place of Ethan Allen Doty, and Henry Siebert has been elected vice-president in place of Edward Packard. The new board of directors consists of Bernard F. Gallagher, Henry Siebert, J. H. Wallace, Daniel J. Creem, George A. Prince, A. W. Dater, Thomas E. Murray, William F. Sheehan, John G. Jenkins, Nicholas F. Brady, Horace C. Du Val, Royal C. Peabody and J. D. Fairchild.

A deed of trust was recorded at the office of the clerk of the Corporation Court at Lynchburg, Va., on the 7th inst., from the Lynchburg Electric Railway & Light Company, conveying to the State Trust Company of New York, trustees, its franchise and all its property for the purpose of securing the payment of $150,000 of bonds, which it is proposed to issue, the money to be applied to the furtherance of the plans of the company in the rehabilitation of their street railroad in Lynchburg.

By order of the board of directors of the Nashville Street Railroad of Nashville, Tenn., Vice-President Bradford gives notice that on the 31st of December the company will pay, on presentation at the First National Bank of Nashville, the principal and accrued interest of fifty bonds for $1,000 each of the South Nashville Street Railroad Company, being Nos. 1 to 50, inclusive, of Series A, secured by mortgage executed by said South Nashville Street Railroad Company. Interest on said bonds will cease after December 31.

The Kansas City (Mo.) "Star" states that the Standard Telephone Company has bought all the lines and equipment of the Central Missouri Telephone Company. This new purchase gives the Standard Company about 1,000 miles of line in Missouri, and when all connections are made it will give Kansas City communication with 150 towns. The Central Missouri system started at Versailles and ran north to Tipton, Booneville, Fayette and Moberly. From Moberly it ran to Mexico and Brunswick. It also connected Moberly with Macon, Gallatin and Trenton.

The Philadelphia "Stockholder" says: "Conspicuous among the 'mystery' stocks is General Electric. Signs are not wanting that a strong speculative clique will undertake to make it attractive marketwise. The current bull point is that net earnings for the past five weeks have been nearly $500,000. It is averred, furthermore, that the company is so burdened with orders as to be compelled to decline contracts calling for prompt delivery. The new stock is said to be in the hands of the pool originally identified with it, and it is declared that these interests will keep it well in hand and gradually advance it to par."

The latest report as to the promoters of the $25,000,000 company recently incorporated at Albany says that they are the Elkins-Widener syndicate of Philadelphia. It is now reported that the company (the New York Gas & Electric Light, Heat & Power Company) has bought for about $6,000,000 the Consolidated Telegraph & Electrical Subway Company of New York, as a necessary step in carrying out its alleged purpose of consolidating the electric lighting business of Greater New York into one concern, and using the surplus power of the street railroad systems in the general scheme for furnishing light and power. A New York writer for the Boston "News Bureau" says: "Some people who ought to be in a position to know what is going on say that among the possibilities is the furnishing of electric light and power by one great corporation for every electric plant in Greater New York, and that this power can be generated at a few central spots and distributed to the limits of the city as may be needed."

The "United States Investor" says: "Boston Elevated stock has been bought in the past week on its future possibilities—on what stockholders may get in the course of two or three years from now, after the elevated structure is completed and the stock has been advanced to $75 per share. As our readers know, only $50 per share has been paid in, the par value being $100, so that the quoted price, $75, means $150 for a full paid share. At present the company is paying on this stock dividends at the rate of 3 per cent. semi annually, or 6 per cent. per annum, which dividends come mostly from the surplus earnings of the West End Street Railway Company, after the charges of the latter company have been met. For a 6 per cent. stock $150 is a pretty good price, but it is figured by 1902 or 1903, say, the company will be earning 9 per cent. net on all the Boston Elevated stock ($10,000,000) after providing for all charges."

At the sale of the Brooklyn elevated roads at the New York Real Estate Exchange on the 10th inst. only three actual bids were made, and these were all by F. P. Olcott, chairman of the reorganization committee of security holders, to whom the properties were knocked down. The bids were as follows: Brooklyn Elevated, $1,750,000; Union Elevated, $3,075,000, and Seaside & Brooklyn Bridge Elevated, $682,500, or a total of $5,507,500. The sale was a foreclosure on the mortgages, and was the first step in the reorganization proceedings. The road has been in the hands of a receiver since November, 1896 and as soon as the new title has been perfected application will be made to the Supreme Court for the discharge of the receiver, when the road will be reorganized on a sound financial basis and with due regard to its earning capacity. President Uhlmann hopes to have the Fifth and Lexington avenue divisions of the system equipped with electricity by midwinter, and the whole of it will be thus equipped, it is expected, by 1900.

ELECTRICITY.

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CONTENTS.

EDITORIAL NOTES.

Death of the Inventor of the Keely Motor.

The death in Philadelphia on the 18th inst. of Mr. John E. W. Keely closes the career of one who during the past quarter of a century succeeded in attracting more world-wide attention through the so-called Keely motor than almost any contemporaneous inventor. Some twenty five years ago the scientific world was startled by the announcement that a motor had been brought out which was to all intents self-operating, and to which Mr. Keely applied the name of "hydro-pneumatic-pulsating-vacuo engine." Scientists, engineers and capitalists carefully examined the motor and watched it operate, and enough confidence was felt in the future of the machine to induce several prominent New Yorkers to form a company capitalized at $100,000 with a view to perfecting the machine and placing it on the market. Machine after machine was built, all proving on being tried experimentally very erratic, sometimes operating and other times not. The principle of working this wonderful motor was kept secret, not even those most interested financially understanding its method of operation. In answer to all questions on the subject Mr. Keely invariably replied that the force made use of was "etheric vapor," but what that force was or how it was applied has never been divulged. By means of it however he proposed to revolutionize mechanics, and in 1875 is quoted as having made the following extravagant statement:

"I propose in about six months to run a train of thirty cars from Philadelphia to New York at the rate of a mile a minute with one small engine, and I will draw all the power out of as much water as you can hold in the palm of your hand. A bucket of water contains enough of this vapor to produce a power sufficient to move the world out of its course. An ordinary steamship can be run so fast with it that it would be split in two."

In spite of Mr. Keely's wonderful predictions, however, the motor never got beyond what might be termed the experimental stage. Exhibitions were occasionally given of its working in his laboratory before engineers and scientists, who endeavored in every possible way to solve the problem of its working, but without avail. Some of those who looked into the matter thought the propelling force was compressed air cleverly arranged to pass through minute tubes resembling in outward appearance wires, but as the motor was never allowed to be taken apart for inspection, these surmises could never be verified. It came generally to be believed however, after thousands of dollars had been spent by outside parties interested in an endeavor to perfect the motor for practical use, that the machine was a humbug so arranged as to operate by some one of the well-known forces of nature, and the fact that the motor was never put to practical use although backed by moneyed men would seem to bear out this belief. In any case the inventor of the Keely motor was undoubtedly an extremely clever man, and managed to derive, so it is alleged, a good living from the enterprise. If the carefully guarded secret of the operation of this machine was kept by the inventor to the last, little more will probably be heard of this Keely mystery, which has from time to time been exciting the curiosity of two continents during the past twenty-five years.

* * *

Automatic Stoking.

That automatic stokers are rapidly being adopted in large central stations is not to be doubted. This is especially so in lighting and power plants situated in the midst of thickly populated districts, owing to the necessity of providing some means of doing away with the smoke nuisance due to incomplete combustion of soft coal. A few years ago in manufacturing centers such as Pittsburg and St. Louis this incomplete combustion of fuel grew to be such a nuisance and brought forth so many complaints from the residents that the proper officials found it necessary to take up the matter if only for hygienic reasons. Committees were therefore appointed, and after a careful examination it was found that relief might be obtained and comparative cleanliness secured by the introduction of mechanical stokers. The cost of installing suitable mechanism for stoking purposes is comparatively high, although experience would seem to show that where automatic stoking has been resorted to the interest on the money invested for the purpose is more than made up for in the long run by the advantages derived, to say nothing of the abatement of the smoke nuisance, which of course as pertaining to the well-being of a community cannot well be reckoned in dollars and cents. The constant and uniform feeding of the fuel by an automatic stoker is conducive to thorough combustion, and where traveling grates are made use of a clean fire is assured. One of the results, and an important one from a pecuniary standpoint, directly due to this method of stoking would seem to be a greater evaporation of water per pound of coal than can be obtained by hand stoking. As an example, some tests made last month at the Belfast Electrical Works in Ireland showed the amount of water evaporated per pound of coal from and at 212° F. to be 11.59 pounds by the use of a mechanical stoker, whereas the hand-firing trial with the same coal showed an evaporation of water per

pound of coal from and at 212° F. of but 10.6 pounds. This would seem to indicate that a lighting or power station with a capacity of 6,000 horse-power hours a day would be obliged to consume, in order to obtain the same power, over a ton more coal a day were the stoking done by hand than if an automatic stoker were made use of. Another indirect source of economy resulting from mechanical firing is the greater length of life of boilers owing to the absence of sudden changes of temperature.

There are at the present day many different types of mechanical stokers on the market, all of which however resemble one another more or less in their operation. The principle on which they operate is quite simple. Hoppers or receptacles of some description are usually provided, into which the coal is deposited either by hand or by means of conveyors. The coal is then pushed forward by either a continuous or intermittent movement on to the grate bars in the furnace. In some types of automatic stokers these grate bars have a reciprocating motion, in others they are made in the form of an endless chain, but invariably they are so arranged that the coal travels toward the back of the furnace. Of course one of the main objects to be attained is the spreading of the coal evenly over the grate bars, and this is accomplished by various devices. In some cases where complete combustion is desirable, as for instance where a power station is located in the heart of a city, a combustion chamber is located at the back of the furnace through which all the gases are obliged to pass before escaping to the open air.

The fact that automatic stokers are conducive to a saving in fuel probably accounts for their gradual adoption by large lighting and power stations, and for this reason rather than with any idea of abolishing the smoke nuisance, mechanical firing will undoubtedly become more and more popular, especially now that the mechanism for this purpose is rapidly being brought to a high state of perfection.

* * *

The Lighting of the Capitol at Washington.

The recent explosion in the Capitol at Washington, resulting in $20,000 damage and the loss of many valuable documents, now attributed to leaking gas, will it is thought have a tendency to hurry the necessary steps looking to the introduction of electricity throughout the building, thus completing the installation of electric lighting which was begun a year or two ago. In cases of violent explosion such as that referred to above, it very frequently happens that electric lights in the vicinity are extinguished owing to a rupture of the conductors or to a breaking of the lamps by the shock. An examination, however, made immediately after the explosion and fire, showed that the electrical installation in the Capitol had in nowise suffered, the incandescent lamps in the basement continuing to burn during and after the explosion, or until it was thought advisable to cut out of circuit the old portion of the building where the explosion took place, so as to avoid any possibility of the live wires interfering with the work of the firemen. Tests were made to ascertain if the circuits were in order, and at no time were there indications of grounding. This may be partially accounted for in the fact that the wiring of the building was done in a most thorough and efficient manner. It was thought at one time that the explosion might have been due to the eating away of a gas pipe by some stray lighting current, but this was shown to be impossible owing to the nature of the wiring. The conductors are all heavily insulated, carried in brackets supported on porcelain knobs, and nowhere make direct contact with any metal.

During the past two years many changes and improvements have been introduced in the Capitol, but probably none have attracted more attention than the electrical equipment in its varied branches. First and foremost among the improvements, at least so far as the comfort of the public is concerned, was the placing of electric lights all through the grounds during the spring of 1897. The past summer has further seen the installation of electric lights in the old Senate Chamber, which is now the home of the Supreme Court. At the present time the work of installing an electric elevator in the Senate end of the building is rapidly progressing and is expected to be completed before the opening of Congress. Preparations have also nearly been completed for the installation of a 250 HP. generating set with a capacity of 3,000 additional lights, or in other words a duplicate of the one installed a few months ago on the Senate side. As soon as the extra plant is completed it is proposed to adopt electricity for almost every purpose, such as the running of elevators, ventilating fans, etc. Gas is still used to a small extent in the Senate end of the building, in a portion of the old building, and for lighting the dome, but taking into consideration the large amount of damage recently occasioned by this form of illuminant, the sooner it is abolished from the Capitol and electricity adopted the better it will be for the safety of the noble pile and all it contains.

Under the Searchlight.

Notes and Comments on Various Topics.

Two clerks in a New York uptown grocery store are firm believers in the force, fierceness and mysterious ways of electricity, and furthermore are now prepared to believe right away anything that Nikola Tesla may claim to be able to do with the electric fluid. These two young men put in a bad quarter of an hour a day or two ago dodging a live wire in action at close quarters, and though they have escaped with nothing worse than unstrung nerves and sundry bumps and bruises from coming in contact with brick walls, they don't want any more such experiences. Time was when the keeper of the grocery used electric light in the store, but he dispensed with it on the ground of economy. It was cut off save in the cellar, where the wires were encased in an iron pipe. On the day in question the two young men were back in the cellar arranging the stock, when what they described as a streak of blue flame burst from the wires in the iron piping, and continued spitting and sputtering in a continuous stream clear across the cellar and barring their exit by the only doorway. After standing the pyrotechnics for about ten minutes and noticing that the wall opposite was getting blackened, one of them thought it time to go for assistance. He placed an empty cracker box over his head and started, but weakened and gave up the job. Then the pair set up a Macedonian cry, and the brother of the proprietor started down the cellar steps. He took in the situation at a glance and then backed up stairs again. His first thought was the telephone, but not knowing what shape that might be in he abandoned it and turned in a fire alarm. An engine company responded, and the assistant foreman running down into the cellar, seized a bale stick, and with a blow on the exposed wire from the iron tubing evidently broke the connection, for the fiery display ceased. Nobody offered any scientific explanation of the occurrence, but all agreed that the fireman had done a risky thing in attacking a live wire with a club.

* * *

True to their custom and their humor on holiday occasions, the American Electrical Works of Providence, R. I., Eugene Phillips general manager, have issued for distribution a Thanksgiving souvenir which is in line with the many amusing conceptions the company have sent forth to add to the felicities of the days they wished to commemorate. The present souvenir consists of a folding card having three parts, on one of which is the picture of a fine plump turkey in a baking-ban, apparently either ready for the oven or for the table, and of a most appetizing appearance. Beneath this, fastened on the card, is what might be taken for a pencil case, but turns out, when examined, to be a small wooden tube, which contains an explanation of the inscription printed beneath, "The point is within." To get at the "point" you pull a stopper to which is attached a large needle with a coil of thread around it, at once suggesting the use to which it might be put in preparing a turkey for the oven. The point of course is on the needle. On the other folding part of the card is an engraving exhibiting all the familiar table attractions of the Thanksgiving dinner, and in the midst, looking quite captivating, "the little brown jug." The middle section of the card is devoted to an explanation of the illustrations and of the courteous intent of the popular company as follows:

Thanksgiving, 1898.

Thanksgiving Day is approaching. We want to remember our friends, so we send you herewith some of the indispensables of a well regulated Thanksgiving dinner—a Rhode Island turkey and "fixings" and a mince pie from a recipe long held in veneration in our family, "Aunt Sarah Ann's Thanksgiving rule," which contained an extra amount of Plums.

Of course we couldn't send you a *real* mince pie or a *real* turkey but we do send a *real* basting needle all threaded for sewing up the turkey. (See the point?)

Our best wishes for an enjoyable day.

By the way there's another point we want to mention—Wire, both Bare and Insulated. You know who makes the best; no need for us to say more.

American Electrical Works,
Providence, R. I.

* * *

Dr. William P. Sensibaugh, a dentist, of Port Byron, Ill., is in a serious condition as a result of a prank played upon him while being initiated in a fraternal insurance lodge. Several slight shocks from a live wire were given to him while he was blindfolded. One of the initiating officers, seeing the candidate was about to evade the wire, gave him a little shove, which threw the dentist off his balance, and he fell hands down upon the battery itself, receiving a shock which made him unconscious. After working over him for two hours and finally reviving him it was discovered that his right arm hung limp and loose, and in this condition it has remained ever since. Soon after, Sensibaugh was stricken with an affection of the pneumogastric nerve, and he has been kept up mainly through electrical treatment. One of the attending physicians says that paralysis of the nerve is threatened, in which event the sufferer cannot live.

* * *

The French are nothing if not original. Since the question as to whether decapitation causes instant death or not, the French Government is said to be seriously considering the adoption of an electrically operated death helmet in lieu of the guillotine. The machine somewhat resembles in appearance the headgear worn by the knights of old. From the top curves a long hollow bar of steel, dividing near its end into two portions, each of the latter terminating in the proximity of two openings in the helmet. In these bars are located two movable appendages to the extremities of which are fastened two long curved needles. In operation these needles would be thrust forward by means of an electric current passing through the mechanism and would bury themselves in the eyes of the criminal, causing instant death. Though possibly an improvement over the guillotine, we doubt if this method of execution would prove popular with the masses in France, who apparently revel in riot and bloodshed.

ELECTRIC CONDUIT SYSTEMS.

BY W. L. HEDENBERG.

When electric traction was first thought of, about twenty years ago, many of those interested in solving the problem went about it in what appeared to be the simplest way, by placing a conductor either along the surface of the ground or just below it. Notwithstanding the fact that the current supplied was at low voltage, the attempts were in the majority of cases failures both from an engineering and financial standpoint. Shortly after these unsuccessful attempts at underground traction, an overhead system of electric traction was developed and successfully tried in Kansas City which for the time being drew attention away from conduit systems. Hundreds of miles of overhead trolley lines were then built in various parts of the country and successfully operated, while the conduit systems had not yet gotten beyond the experimental stage. Although economical to construct and fairly economical to operate, defects in the overhead system became more and more apparent, especially for urban use, and inventors again turned their attention to conduit

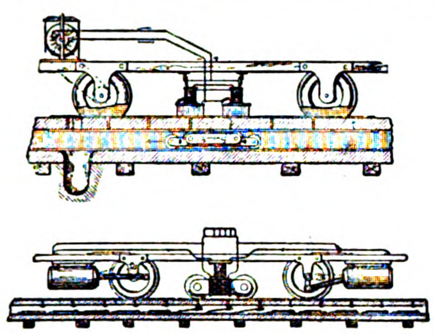


FIG. 1.
Van Depoele Closed Conduit Systems.

traction. During 1887-1888 a number of conduit systems were brought out. Some of these were tried experimentally on short stretches of track with questionable success. The aim of these early inventors was apparently to develop a conduit system which could be built for from $12,000 to $15,000 a mile, and thus successfully compete in cost of construction with the overhead trolley. This necessitated the laying of a very shallow conduit, with the result that the latter was constantly getting out of alignment with the track and causing the plow on the car to frequently run off the conductor. Another defect to be overcome was loss of current through leakage, which invariably occurred in wet weather. In the early nineties the conduit systems which were being experimented with in this country could be divided into three general classes—those having a sealed conduit, those having a semi-open or slotted conduit and those having an open conduit. The object of a sealed conduit was to prevent moisture as far as possible from reaching the conductor, with a view to reducing the loss of current through leakage. The conduit was usually located in the center of the track and provided with an exposed rail or contact pins for collecting the current. The surface conductor was almost invariably thrown in circuit through the medium of a powerful magnet carried by the car and acting on some switching mechanism in the conduit. Two systems of this description are shown in Fig. 1, both invented by Van Depoele. In the upper illustration a magnet on the car draws along a contact carriage which establishes electrical connections between the conductor in the closed conduit and the surface plate through the medium of contact pins. The current is then collected by metal brushes and delivered to the motors. The lower cut shows another form of surface contact system in which electrical communication is established between the conductor in the sealed conduit and the surface plate by means of movable arms which are lifted by the magnet on the car. An early contact system very similar to that just described is shown in Fig. 2. This system, invented by Pollak and Binswanger in England in 1886, apparently differs from that of Van Depoele only in the arrangement of the magnets and in the means used for collecting the current. In another type of closed conduit a movable flat conductor is made use of, which is raised from the bottom to the top of the conduit as

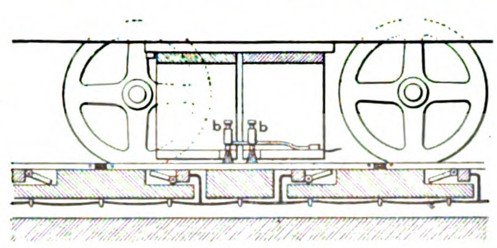


FIG. 2.
Pollak and Binswanger Closed Conduit System.

the car passes over it, as usual through the medium of an electro-magnet. In all systems of this description the surface plate is invariably divided up into short sections of from six to fourteen feet in length, insulated one from the other. By this arrangement there is no live section except that directly under the car.

Patents have been granted on numerous closed conduit systems, none of which, however, have gotten beyond the experimental stage. The objections raised against this type of conduit are that in winter it would be difficult to keep the surface contact plate free of snow and ice, and that where there are movable parts in a conduit which cannot readily be gotten at there is always danger of, for instance,

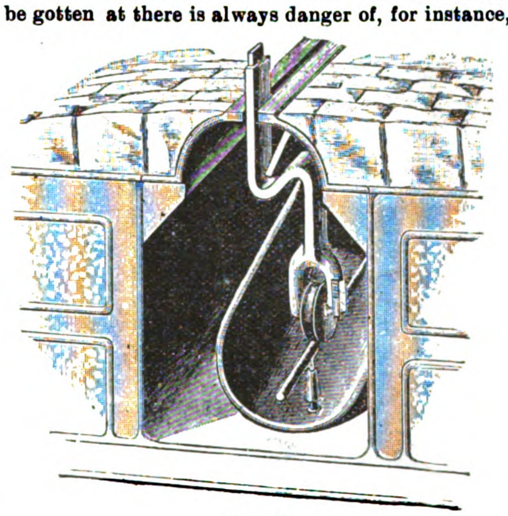


FIG. 3.
Griffin Semi-Closed Conduit System.

an arm not dropping after a car has passed, thus leaving the surface contact alive. In short, the sealed conduit has not proven successful if we except possibly an experimental line now in operation in England for which great things are hoped.

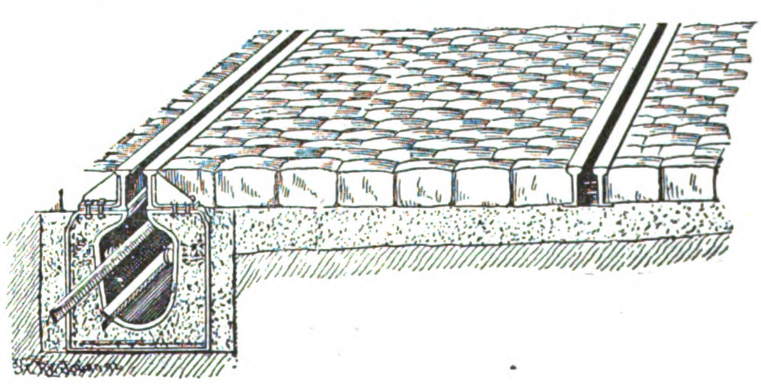


FIG. 5.
Section of Budapest Conduit Electric Railway.

Of the semi-open type of conduit there are innumerable examples. The idea of those who have invented this style of conduit was as a rule to gain all the advantages to be derived from the use of a direct movable contact and at the same time shield the conductors from dampness with a view to preventing loss of current. An example of this type of conduit may be seen in Fig. 3. Here, as will readily be seen, the plow bends into a second compartment arranged so as not to collect water. Almost every conceivable combination of mechanism has been thought of in this connection and scores of patents granted.

Another type of semi-closed conduit is shown in Fig. 4. In this system the conduit, which is but 12 inches deep, is placed under one of the track rails, the plow having two small grooved wheels as well as a sweeper attached to it, fastened to the side bars of the truck. As the plow moves forward it lifts a short rod which, as may be seen by the illustration, throws a switch allowing current to pass from the main feeder to the rod from which it is collected and delivered to the motors. As in most all systems of this type, but one section of rod is charged with

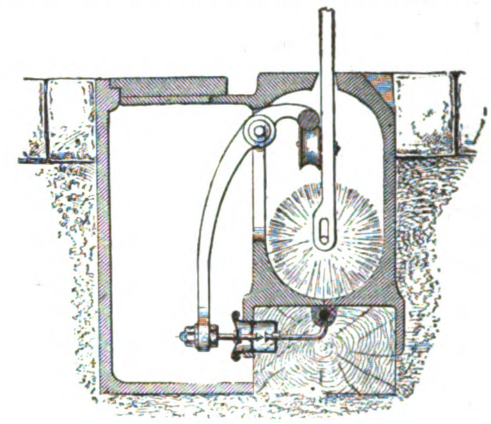


FIG. 4.
La Burt Semi-Closed Conduit System.

current at a time and that section is directly under the car. The cost of such a conduit system is given by the inventor at from $10,000 to $15,000 a mile, according to the conditions and requirements. A few of these semi-open systems have been tried on an experimental scale, but with scarcely more success than with the sealed type of conduit. In the majority of cases the difficulty lay in the complexity of the mechanism and in the endeavor of the inventor to keep the cost per mile down to from $15,000 to $20,000. In other words, most of the designs brought out were for cheap systems and consequently gave poor results even when tried experimentally.

Under this head of semi-open conduits it might be in place to mention a rather novel railway system invented about a year ago by a resident of Chicago. The conduit is quite shallow, being but sixteen inches in depth by four inches in width. In the pavement on either side of the slot are located two castings. Through the center of the latter a large circular hole is bored at right angles to the line of the track. Within this aperture a movable brass cylinder is located and within the cylinder is placed a heavily insulated metal rod. On the end of the

latter, which extends into the conduit, is an ordinary trolley wheel. The movable brass cylinder is provided with two springs which tend to move it forward and away from the charged conductor. Each car is equipped with a wedge-shaped plow, twenty-one feet in length, which, when the vehicle is in motion, strikes between two opposite pulleys, one positive and the other negative, and presses them back against the action of the springs. In this manner connection is made with the line conductors situated under each rail. The current then passes through the insulated metal rod and by means of the trolley

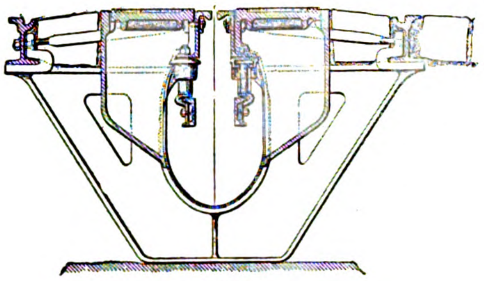


FIG. 6.
Yoke used on Lenox Avenue System.

wheel to the plow on the car and from there to the motors, the negative current passing out in the same manner on the opposite side. As a plow on a car is slightly longer than the distance between the switch boxes, the front of the plow reaches the next set of pulleys before it leaves the rear set, thus insuring a continuous flow of current through the motors. The general arrangement in this system, as will be observed, is the reverse of that usually met with, the long plow on the car in reality taking the place of the continuous conductor. The inventor claims that this system is a great improvement over the designs heretofore brought out, there being no current in the conduit except where the car happens to be, and the end of the rod where it is pushed in to receive the current being in an air-tight space where no water or moisture can gain access. An attempt was made some time ago to induce a Chicago street railway company to give this system a trial, but whether this has been done or not the writer is unable to say.

In the summer of 1889 a conduit system with a bare conductor was for the first time successfully operated in Budapest, Austria-Hungary, and attracted wide attention. The conduit was located, as shown in Fig. 5, under one track rail. It is oval in shape, 11 inches wide by 16 inches deep, lined with iron embedded in concrete and supported every four feet by iron yokes. The slot, which is over an inch in width, is made up of two beam rails having no inside lower flange and fastened to the conduit by angle irons. The conductors, both positive and negative, are made of angle iron secured by means of suitable insulating material to the casting. They are sufficiently high above the floor of the conduit to be protected from any water which may find its way in. The current is collected by means of a double tread wheel with a flange in the center. The success in the operation of this road was apparently due to a combination of circumstances. In the first place, no expense was spared in the laying of the conduit to ensure its solidity and durability. As previously stated, iron yokes were used throughout with a view to keeping the conduit in perfect alignment. Another circumstance which tended to the successful operation of this system was the climate, there being comparatively little rainfall.

A careful study of the Budapest electric conduit system convinced many of those engaged in solving the problem of conduit traction that a system in order to work successfully would have to be built in a substantial manner and less pains taken in shielding the conductor than in properly draining the conduit and having it sufficiently roomy to allow of the conductor and its supports being frequently inspected. Accordingly in 1894 the Metropolitan Street Railway Company of New York City began the construction of an electric conduit system on Lenox avenue. With a view to converting this road into a cable line providing the attempt at electrical traction proved a failure, the conduit was built in a most substantial manner. Heavy iron yokes were placed at intervals of five feet to support the conduit and the latter was embedded in concrete. As shown in Fig. 6, the electrical conductors were suspended by suitable insulators every fifteen feet, at which points

FIG. 7.
Underground Trolley Construction on Fourth Avenue.

hand holes were built to allow of frequent and careful inspection. This line was completed in June, 1895, and was given a thorough trial during the winter of 1895–96. With a view to reducing to a minimum the chance of an accident occurring, at first a voltage of 350 was used, which however was

FIG. 8.
Some of the difficulties encountered at Fourth Avenue and Fourteenth Street.

found not to be economical and was subsequently raised to 500. With the exception of a few unavoidable mishaps the line worked satisfactorily, neither snow nor rain causing it to fail through excessive leakage.

The Lenox avenue line having proven successful, the same system with a few changes was then rapidly installed on the Second avenue, Madison avenue, Eighth avenue, Amsterdam avenue and Fifty-ninth street lines. At the present time steps are being taken towards abandoning the cable on Broadway for electricity, while an electric conduit system is being substituted for the out-of-date horse cars on the Sixth avenue line. It is the intention of the Metropolitan Street Railway Company to gradually do away with cable traction on all of its lines, substituting for it conduit electric traction, as the latter motive power has been found more flexible for crowded thoroughfares as well as more economical in operation. In a recent article published in the *Street Railway Journal* giving the operating expenses of the Metropolitan Street Railway Company during the past year, the cost of the various methods of traction are given as follows: Horse lines 17.87 cents per car mile, cable lines 16.42 cents per car mile, and electric traction 10 23 cents per car mile. The converting of a horse car line, as for instance that on Sixth avenue, to electricity is exceedingly costly, owing to the depth at which it is necessary to excavate and the large number of underground structures, such as water and gas mains, which it is necessary to lower or move to one side. An idea of the

amount of work the building of an electric conduit system entails in New York City may be gathered from Figs. 7 and 8. The actual cost per mile of single track usually ranges between $60,000 and $80,000, depending of course on the number of obstacles encountered. With a view to being in a position to generate sufficient power to operate all its electric lines in this city when completed, the Metropolitan Street Railway Company is at present erecting a mammoth power house at Ninety-sixth street and First avenue. The building when finished will occupy a space of about 55,800 square feet and will rest on an extremely solid foundation, consisting of some 8,000 piles covered with a four foot layer of concrete. A view of the station in course of construction is shown in Fig. 9. The completed station will have a capacity of 70,000 horse power. The engines of 4,000 nominal horse power each will be located in a room 200 ft. in length by 110 ft. in width. The boiler room will contain 87 water tube boilers rated at 250 HP., with a maximum capacity however of 400 HP. each. The generators will be of the three-phase alternating-current type capable of transmitting current at a pressure of 6,000 volts. To ensure a good draught the chimney will be 350 feet in height with a diameter of 22 feet.

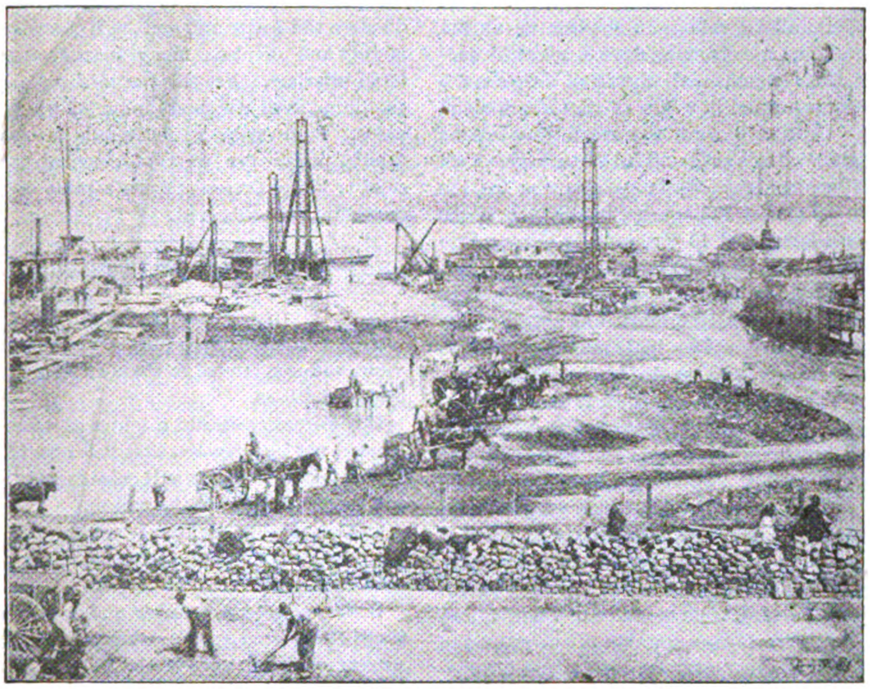


FIG. 9.
View of Power House Site, Ninety-sixth Street and First Avenue.

At the present time, out of about two hundred miles of track controlled by the Metropolitan Company in New York City, some seventy miles are operated by electricity, and the latter motive power is being so rapidly substituted for other forms that the dawning of the new century should find but few if any cable or horse lines within the city limits, especially now that the Third Avenue Railroad Company has also recently decided to operate its lines electrically.

Constitution and Resistance of Mercury.

At the recent congress held by La Société Allemande d'Electrochimie at Leipzig, a paper was communicated by M. Liebenow with regard to the constitution of mercury. From his experiments it appears that the electrical resistance of the alloys depends principally upon the molecular grouping, i. e., upon the number of atoms forming the molecule of the solid substance. In the case of solid mercury the molecular grouping is extremely complex, but in the gaseous condition it is probably monoatomic. It is remarkable that, whereas for most pure metals, including solid mercury, the temperature coefficient for resistance is in the neighborhood of 0.004 per 1° C., whilst for liquid mercury the coefficient is only 0.001. Liquid mercury appears to be a mixture of monoatomic molecules and the more complex groupings characteristic of the solid condition.

IMPROVEMENTS IN THE ARC LAMP.*

BY ROBERT A. ROSS, E. E.

The prominent place which the arc lamp took in the earlier years of electric lighting, involving as it did the designing and operation of the complicated series arc machine, has always excited comment, and the permanency of the types of apparatus then designed is astonishing. From the commercial beginning of arc lighting in the year 1879 up till the present, the direct current series lamp has undergone comparatively little change except in the smaller details. It is true that during the earlier years the questions of open and closed circuit types, of clockwork, clutch and rack feeds were fiercely discussed, but the lamps which have stood the test of time and which are now considered good commercial articles are much as they were when originally designed.

During the first eleven years of its existence the series arc lamp stood alone, in spite of the fact that the need was apparent for other types which would operate on the constant potential lines of direct and alternating systems. The result of the attempts to develop these types has been to produce in 1890 the constant potential direct current arc lamp to operate two in series on the 110 volt incandescent service lines, to give us, about 1892, the alternating current constant potential type, and in 1894 the enclosed type of the direct current arc.

At the present time all of these types are in successful operation, and in addition during the past year the enclosed alternating lamp has attained a thoroughly commercial form. The development of the several arc lighting systems by series, parallel, direct and alternating current distribution has depended upon the development of suitable lamps alone, and gave us the series direct current system first, because of the simplicity of operation of the series lamp. The reason of this simplicity of operation is not far to seek, if we remember that after the arc is struck the regulating mechanism performs but one function, namely, to regulate the arc voltage, the current regulation being done at the machine regulator. On the other hand, the lamp mechanism for operation between constant potential lines regulates the arc voltage as well as the current, and as a consequence there is going on at all times a struggle between the forces by which these two factors are governed. It is this chiefly which necessitates the placing of a resistance in series with these lamps to prevent pumping. This trouble is not so apparent in the alternating type with which a choke or economy coil is used, as in addition to the resistance of the coil the inductance is of effect to dam back excessive current rushes. Another feature which long held the lamp for parallel operation in the background was the fact that the art of carbon-making had not advanced sufficiently to admit of the commercial manufacture of the high grades necessary for its successful operation. On the other hand, the force which has been of greatest effect in developing the constant potential type was the necessity which existed for the use of arc lamps on the incandescent service lines and the consequent uniformity and simplicity of the line and station equipment. The advantages attendant upon the use of the constant potential lamp have at the present practically banished the series arc from the field of interior lighting, and in many new plants are leaving no place for it even in what has been considered its own peculiar field, that of street lighting.

The question whether the series arc will retain its supremacy for outside illumination will depend largely upon whether machines capable of being direct connected or at least belted direct to fair sized engines can be built and operated. There seems to be a fair prospect of this, if we are to judge by the results of the past four or five years, within which time the limit of size has passed from about sixty to three times that number of lamps per machine. It is evident, however, that the limitations of safety will prevent the grouping of any such large number as might be desirable for other reasons on a simple series loop, and will force the adoption of systems of return loops as in the Brush machine, where several circuits are run from the same machine and the line to line potential on each circuit correspondingly reduced, or by some other series parallel grouping of circuits which will give the effect of keeping down excessive line voltages while admitting of the use of large units in the station.

The advantages which the series system possesses for the distribution and control of light over large areas when coupled with the equally evident advantage of the use of alternating current generators, which are the standard type for most stations, have long been recognized, and some fairly successful attempts have been made to use alternating current lamps on series alternating circuits taken either from the constant potential bus bars of the station which feed the incandescent service primaries, or from the same bus bars through a self-regulating transformer, which gives a constant current through the lamps placed in series on the circuit. As to the operation of these circuits there appears to be no great difficulty, and were it not for the fact that the light distribution from the alternating lamp is poor, and the cost of the superior carbons, which are necessarily so high, there is no apparent reason why this system should not displace the direct current series system with its separate and special generating units, thus permitting the distribution of incandescent and arc lighting from the same generators and the separate control of the arc lights as on the direct current series system at present in use. There appears to be a large field for this system in spite of the disadvantages mentioned above.

The development of the enclosed arc lamp has been a curious example of the effect of preconceived ideas in holding back much needed inventions. As early as 1846, Staite recognizing the need for the enclosed arc with its long burning advantages, undertook its development, but without success, as were

* From *Canadian Electrical News.*

the efforts of others up till about 1894, when the lamp became a commercial success. The chief reason for the failures up to that time was that the endeavor had been to produce an arc similar to that in the open series lamp, which in the light of later knowledge was a mistake.

The open lamp has a normal arc of 45 volts, while the enclosed works to best advantage at about 80, the arc at the higher potential being much more stable and giving a better distribution of the light than at the lower voltage at which most of the experiments up till 1894 had been made. In addition to this misconception of the value of the long arc which enclosure made possible, the difficulty of obtaining enclosing globes which would withstand the heat, and the commercial impossibility of obtaining pure carbons which would not darken the globe, delayed seriously the appearance of the enclosed arc. These difficulties overcome, the increased voltage of the arc which in the series system is a disadvantage, were seen to be of decided advantage, as it enabled the lamp to be operated and controlled singly from the constant potential 110 volt lines from which the incandescent lighting was wired instead of two in series across the lines as the practice was with the open arc.

In comparing the relative advantages of open and enclosed arc lamps we find as follows:

1. That the enclosed type will burn for from 100 to 150 hours with one recarboning, as compared with 8 hours for single open lamps, the cost of the carboning and trimming being reduced in proportion.

2. For operation on constant potential circuits the ability to operate one enclosed as compared with two open lamps across the mains is a very evident advantage.

3. No dust, sparks or hissing from the enclosed lamp.

4. Simpler mechanism, and better regulation due to the longer arc, and less flickering in the enclosed type, as it feeds but one-fifteenth to one-twentieth as often as the open arc.

5. As compared with the series circuit open arc, the enclosed constant potential lamp operates on a low and very safe voltage, and may be handled and operated precisely as an incandescent lamp, thus making it especially suitable for interior illumination.

These are all advantages on the side of the enclosed type, but against this we must balance the decreased light giving power per watt of consumption due to the use of the opaline or ground enclosing globes which are necessary for the proper diffusion of the light, and the loss of light due to the smutting of the globes with carbon dust, which becomes a serious matter after about 100 hours of running; also there is the extra cleaning of the enclosing globe and the maintenance of same.

For interior illumination, however, where a ground globe is a necessity for proper diffusion in both cases the open and closed types are on an equality so far as light giving efficiency is concerned.

It appears, therefore, that for all purposes of interior illumination and in many cases of outside lighting, the enclosed arc has decidedly the advantage, and the records in the larger cities of the United States show that these advantages have been recognized, and for most of the new installations of arc lamps the enclosed has been selected as the most suitable.

For the purpose of showing the different light giving efficiencies of the various types of lamps, as well as to place in accessible form the usual voltages and amperes in use in their respective arcs, the following table has been figured on the basis of 450 watts consumption at the arc in each case, that being the standard usually adopted. To complete the combinations all of the probable systems are considered, although several are not much used as yet, but the figures indicate what may be expected when they are adopted as the lamps are developed for all of them:

LIGHT-GIVING EFFICIENCIES OF DIFFERENT ARC LIGHT SYSTEMS.

	Amperes.	Volts in		Watts in		Candle power.		Watts. Per C. P.		C. P. per H. P.	
		Arc.	Line.	Arc.	Line.	Outside.	Inside.	Outside.	Inside.	Outside.	Inside.
	1	2	3	4	5	6	7	8	9	10	11
Direct Current.											
Serie open	10	45	50	450	500	650	450	.7	1.0	750	520
Series enclosed	6.5	70	75	450	500	875	450	1.2	1.0	440	520
Constant potential open	10	45	55	450	550	650	450	.7	1.0	750	520
Constant potential enclosed	5.6	80	104	450	580	875	450	1.2	1.0	440	520
Alternating Current.											
Series open	15	30	33	450	500	375	300	1.2	1.5	470	370
Series enclosed	6.5	70	75	450	500	225	300	2.0	1.5	285	370
Constant potential open	15	30	33	450	500	375	300	1.2	1.5	470	370
Constant potential enclosed	6.5	70	75	450	500	225	300	2.0	1.5	285	370

Columns 1 and 2 give the volts and amperes at the arc; column 3 the voltage in the line or at the terminals of the transforming device, which is necessary for their commercial operation. Column 5 gives the consumption in watts at the terminals of the lamp. Column 6 gives the mean illumination of horizontal surfaces or the useful illumination from the lower hemisphere of the lamp, allowing for the absorption of light of 10 per cent. in the clear globe of the open lamp, and 40 per cent. in the opaline globes which are necessary for the enclosed type. If opaline or ground globes be used for all types, as should be done in the illumination of interiors, the useful candle power is given in column 7, in which due allowance has been made for the effect of the upper hemisphere of light, of which it has been considered that 50 per cent. of that passing above the horizontal lines is reflected from walls and ceilings and becomes useful. These figures have been obtained from a number of tests which vary widely, and can be considered as being as nearly as possible an approximation to average conditions. Columns 8 and 9 give the average watts at the arc per useful candle power figured from columns 6, 7 and 4, and indicate the probable consumption of energy in the arc per useful candle power for inside, and for outside lighting with the several systems. Columns 10 and 11 are figured from columns 8 and 9 and indicate the useful candle powers which may be expected per belt horse power in the station, allowing for fair average commercial efficiencies of generators, lines, transformers, choke coils, etc. The figures in column 10 indicate that for out-door illumination, where clear globes are used on the open lamps and opaline on the enclosed type, to give a proper distribution the useful light giving efficiency of the direct current enclosed type is 60 per cent., of the alternating current open type 70 per cent., and of the alternating current enclosed type 40 per cent. of the direct current series arc per unit of energy in the station at the dynamo pulley. Column 11 indicates that for interior illumination where opaline globes are used on all types to get proper dispersion, the direct current lamps on all systems are on a par, and the alternating lamp efficiency in all cases about 70 per cent of the direct. In considering these results it must be remembered that the series machine is much less efficient than the constant potential machine, which makes up for the smaller efficiency of the lamps on that system, and that the alternating arcs have a large light giving area above the horizontal which is considered as partially useful in columns 7 and 11 for inside lighting, but is considered as wasted for out-door illumination in columns 6 and 10. The direct current type, owing to the shape of the positive carbon, throws its light mainly downwards, and the upper hemisphere of light plays little part in interior illumination.

From the above considerations it appears that for outside illumination the series open arc will hold its own where the question of the simplification of the plant by doing away with the arc machines is not given first place. For interior lighting on the other hand, the enclosed direct current, or the alternating lamp of either open or closed types, will certainly displace the series arc, and will broaden that field largely and displace many incandescent lamps in large interiors. For this purpose arc lamps of small candle powers which are now offering will find a place. It must be remembered however, that the candle power per watt of consumption for these smaller lamps decreases quite rapidly as the current consumption is lowered.

HOW FUEL IS WASTED IN CENTRAL STATIONS.

BY F. BRUTON.

This article is from a purely mechanical point of view, and is intended to show how fuel is wasted in central stations.

However insignificant a source of waste may seem, it must not be forgotten that it is one of the many, which taken together will considerably increase the coal bill at the end of the month.

Taking the boilers first, it may be said that one of the greatest sources of waste is the leakage from the safety valves.

If the boilers are working under favorable conditions, there is no excuse whatever for the slightest wheeze of steam, and where the valves are allowed to blow continually at full steam pressure, or 5 lbs. under, it shows gross neglect.

It is a great mistake for boilers to blow off at or about the working pressure. The safety valve should be regulated so as to lift at 5 lbs. above the working pressure. This will give the fireman a chance to "burn down" and "clean" his fires without letting the steam down below the working pressure, and avoid blowing off.

Nothing is more distracting and confusing than steam roaring away; more often than not there is quite enough noise in the engine-room without the aid of the boiler-house.

The rule allowing a margin of 5 lbs. does not hold good if the safety-valves are not tight on their seats. A badly seated valve will blow considerably below the working pressure.

These valves require grinding in with fine emery powder from time to time.

The operation is one which needs a fair amount of skill, and should be done by a mechanic—not the fireman.

The practice of putting weights on the lever of a safety-valve, in order to prevent steam escaping, is not only useless, but dangerous. Grinding in is the only remedy.

A disadvantage of lever safety-valves is that they may be tampered with in this way; but with spring-loaded valves, when once set and locked up, they cannot be altered in any way, and should a particle of dirt get between the valve and seating, causing steam to blow, a slight twist of the spindle will often stop it.

The blow-out apparatus is sometimes responsible for a good deal of waste. When a boiler is laid off

* From *Electricity*, London.

for cleaning, etc., the blow-out cock should be examined, and if necessary, ground in.

If the plug leaks it will be corroded and show signs of unequal wear. Before replacing the plug after grinding in, it should be rubbed over with black-lead and tallow, as this greatly facilitates its working when in use.

The waste pipe from the blow-off cock should be placed where any leakage can be detected.

The undue formation of scale and neglect in cleaning a boiler is another source of waste. Every engineer knows that a certain amount of scale is beneficial to a boiler, as it protects the plates from the injurious effects of impure feed water; but when it becomes too thick it not only wastes fuel, but may cause the furnace crowns to overheat.

A boiler should be laid off for inspection about every month or six weeks, all superfluous scale removed, and flues cleaned.

Soot is a non-conductor of heat, and therefore fuel is wasted when the flues are dirty.

Bad firing means waste of fuel.

Men are sometimes employed who are mere novices at firing, with the result that they waste a large quantity of good fuel, especially when cleaning fires. It is far better to engage men who are experienced.

Leaving the boilers, waste may be looked for in the following: (1) Leaky joints; (2) steam traps; (3) leaky slide valves and glands; (4) running large engines underloaded.

Joints are often allowed to blow until they get so bad that they are nuisances, drowning any noise about the machinery which may warn the man in charge that something is wrong. When a joint begins to blow it might as well be made at once, for it's only a matter of time till it becomes a necessity. A good joint for steam piping is a corrugated metallic ring, spread with putty or cement.

The disadvantage of using asbestos is that unless a joint is screwed up once or twice after making, the expansion and contraction of the steam piping is apt to loosen it and it soon begins to leak again.

Asbestos is more suitable for covers, blank flanges, etc. Steam traps frequently do more than is required—they pass steam in addition to water.

A far more economical arrangement is an interceptor or catch-water. This consists of a vessel fitted with a plate three-quarter way down the middle. The water coming through with steam impinges against the plate and falls to the bottom, the steam passing down under the plate and out at the top on the other side. The vessel is also fitted with a water gauge and drain cock. Every now and again the water is blown out into the feed water tank. Leaky pistons and slide valves are often met with, due to the fact that they are not looked after to the same extent they should be.

Speaking generally, there seems to be a want of mechanical knowledge in central stations, and the common impression is that as long as the electrical portion is all right it does not matter about the mechanical part. But here is a grand mistake—the mechanical is the more important part. It has been said, and not without reason, that a man is an engineer first and an electrician after.

Leaky valves not only waste fuel, but they upset the governing arrangements of an engine. In a compound engine the steam passes the valve into the low-pressure side, causing this side to do more work than it would if the slide valve was steam tight.

An engine should be indicated periodically, and if the slide valve leaks it will be seen by the expansion line on the card rising, instead of falling gradually to the point of cut-off.

The remedy in this case is to reface the valve, or if a piston valve, to fit new springs or reline valve chamber.

The practice of running large engines at light loads is to be condemned. As soon as the load falls to the full output of the next size set, it should be thrown on to it. If there is any doubt about the engine being unable to do the load for which it was designed the engine ought to be tested, the sooner the better.

The causes of waste of fuel in central stations recited above do not cover the whole of the ground. It would be absurd to attempt to do so exhaustively here; but it is intended to show the waste which very often goes on during the ordinary running of a station.

Much might be written on waste due to bad design, but that would be opening up fresh ground, and altogether out of the scope of the present subject. When plant has once been laid down it is rather a difficult as well as an expensive matter to rectify errors of judgment.

ELECTRICITY IN AGRICULTURE.

In the *Electrotechnische Zeitschrift* of October 20, says the *Electrical Review*, London, two successful installations of electric plowing are described. According to the figures given, the cost of electric plowing compares very favorably with the cost of steam plowing, at least in Germany.

In the first case described, a farm (Dahlwitz by name) is supplied with its whole light and power from a central station of 60 HP. For lighting, an alternating current at 1,000 volts is used, the voltage being transformed down at the place where it is consumed; while for driving pumps, threshing machines, plows and other machinery, a direct current of 500 volts is utilized. Herr v. Treskow, the owner of Dahlwitz, estimates the total consumption of energy to be 111,300 HP. hours per annum, about half of which is used to work the electric plow; 250 acres are plowed per annum, and the cost, according to Treskow's calculation, is 31s. 3d. per acre, which is considerably cheaper than steam plowing.

Experiments on the royal demesnes, Sillium and Cloeden, have led to similar results. A communication by the Minister of Agriculture to the members of the Prussian House of Delegates, puts the cost of electric plowing in heavy soil, with deep cultivation, at 45s. to 55s. per acre, and that of steam plowing at 85s. per acre. Besides this reduction in the cost of plowing, it is to be remembered that power required for other purposes on the farm is reduced in cost to almost the same extent.

The system employed at Dahlwitz is the so-called single machine system, and was installed by F. Brutschke, of Charlottenburg. The mechanical apparatus was made by the firm of Borsig. The 500-volt direct current is carried by aerial lines between the fields, and at suitable places on the poles are couplings for connecting up the movable cables which lead the current to the motor. Cable drums are not used, the redundant length of cable being laid by hand in large coils on two carriers fixed on the motor wagon. The motor wagon contains a motor which drives the winding drums, and which can also be coupled to the driving wheels of the wagon, to give it the necessary advance at the end of each traverse of the plow. The rope (15 mm. diameter) runs off one drum in the direction of motion of the plow to the other end of the field where it passes round a loose pulley and then back to the second winding drum on the motor wagon. The rope winds itself on to one drum and off the other till the plow comes to the end of the furrow.

Of course during the approach of the plow the tension on the loose pulley is double that on the rope, and the wagon on which the pulley is mounted must be very firmly anchored. This is done by means of an anchor with four prongs, which bury themselves deep in the ground when the tension comes on the rope. While the plow is on its return journey in the direction of the motor wagon the loose pulley is almost entirely free from tension, and advantage is taken of this to pull the anchor out of the ground by screw gearing driven from the loose pulley. A second coupling then throws the loose pulley into gear with a small drum, which winds on an anchored rope, and causes the pulley wagon to advance a step into position for the next furrow. The attendant then disengages the coupling, and allows the main anchor to fall down. As in steam plowing, the motor wagon is advanced at the end of each traverse by coupling the motor to the driving wheels. Three men are required to attend to the plow. The depth of the furrow was 20 to 25 cm., the width about 130 cm., and the speed of plowing 1 meter per second. The consumption of current in the central station varied from 30 to 50 amperes at the 500 volts.

Electricity in Italy.

According to *L'Elettricita*, electricity as a motive power is rapidly being adopted for various purposes in Italy. At Naples the construction of an electric street railway is progressing rapidly which when completed will connect the Museum and the Toretto. This it is claimed is the first step towards the transformation of the whole Neapolitan street railway system—a matter which will shortly be considered by the Municipal Council. The municipal authorities of Savona have petitioned the Postmaster-General to connect their town with Genoa. A company has been formed in Turin for the purpose of building an electric trolley line from Varallo to Aragna. Another company has been formed in Bologna for the purpose of manufacturing and distributing current for lighting and motor purposes. The Mediterranean Railway Company is going to try electricity on its lines. The first trials will be made on the line from Milan to Gallarato and the three branch lines to Arona, Varese and Laveno. In all 34 applications have been made for water power for the generation of electrical current; 29 of these have been granted, as being able to supply that demand without damaging other interests. From the above it will be seen that electrical undertakings are flourishing in sunny Italy.

Incandescent Lamps and Coal Mine Explosions.

In the *Revue Industrielle* of October 29, Messrs. H. Couriot and J. Meunier describe some interesting experiments in which known mixtures of air and methane, similar to the well-known "firedamp," are introduced into electric incandescent lamps. In the case of 10 CP. lamps, the current being equal to 0.8 ampere, and the pressure to 45 volts, the filament almost instantaneously ceased to be luminous, except at a certain point where a rupture occurred soon afterwards, accompanied by a minute spark. No explosion was produced. Similar results, says the *Electrical Engineer*, London, were obtained with lamps carrying greater currents. The authors explain these results in consonance with a former communication, wherein it was shown that incandescent metallic filaments are powerless to produce explosions even in the most explosive mixtures.

Connecticut Street Railway Association.

The 4th annual meeting of the above Association was held at New Haven on the 16th inst. The meeting was interesting, one of the questions discussed being that of protecting their interests in the event of any legislation detrimental to street railway progress or prosperity. The officers elected for the ensuing year were as follows: President, Henry S. Parmelee, Fair Haven and Westville Railroad Company; vice-president, Congressman E. J. Hill, Norwalk Street Railroad Company; treasurer, E. S. Goodrich, Hartford Street Railroad Company; secretary, B. W. Porter, Derby Street Railroad Company; executive board: President Parmelee, Vice-President E. J. Hill, A. M. Young of the Waterbury Traction Company, C. S. Treadway of the Bristol and Plainville Tramway Company and A. W. Mather of the Central and Electric Railroad Company, New Britain.

MR. TESLA AND "THE ELECTRICAL ENGINEER."

New York, Nov. 18, 1898.
46 and 48 E. Houston St.

Editor ELECTRICITY.

DEAR SIR: Under inclosure I forward you a copy of a letter which is self-explanatory. If you consider it a justice to me to insert it in your next issue, kindly do so. Yours very truly,

N. TESLA.

[INCLOSURE.]

New York, Nov. 18, 1898.
46 and 48 E. Houston St.

Editor of the *Electrical Engineer*,
120 Liberty St., New York City.

SIR: By publishing in your columns of November 17th my recent contribution to the Electro-Therapeutic Society you have finally succeeded—after many vain attempts made during a number of years—in causing me a serious injury. It has cost me great pains to write that paper and I have expected to see it appear among other dignified contributions of its kind, and, I confess, the wound is deep. But you will have no opportunity for inflicting a similar one, as I propose to take better care of my papers in the future. In what manner you have secured this one in advance of other electrical periodicals who had an equal right to the same, rests with the secretary of the Society to explain.

Your editorial comment would not concern me in the least, were it not my duty to take note of it. On more than one occasion you have offended me, but in my qualities both as Christian and philosopher I have always forgiven you and have only pitied you for your errors. This time, though, your offence is graver than the previous ones, for you have dared to cast a shadow on my honor.

No doubt you must have in your possession, from the illustrious men whom you quote, tangible proofs in support of your statement reflecting on my honesty. Being a bearer of great honors from a number of American universities, it is my duty, in view of the slur thus cast upon them, to exact from you that in your next issue you produce these, together with this letter, which, in justice to myself, I am forwarding to other electrical journals. In the absence of such proofs, which would put me in the position to seek redress elsewhere, I require that, together with the preceding, you publish instead a complete and humble apology for your insulting remark which reflects on me as well as those who honor me.

On this condition I will again forgive you, but I would advise you to limit yourself in your future attacks to statements for which you are not liable to be punished by law.

N. TESLA.

[The editorial of the *Electrical Engineer* referred to in the above letter is reproduced below, and we give it space as an act of justice to the parties concerned and for the enlightenment of our readers as to the character of the offence charged.—ED. ELECTRICITY]:

MR. TESLA AND THE CZAR.

The personality of Mr. Tesla is one of the most fascinating in the field of modern invention, and his work is such as to command the interest of both the lay and the scientific public whenever he chooses to give details of his investigations and researches. If he had never done more than develop the theory and practice of the multiphase system, his life would have been useful above the ordinary; and even should it happen that none of his other ideas ever get into practical shape, his discoveries in electricity must always be regarded as important. We cannot number ourselves among those who, like the distinguished scientists, Profs. Brackett and Dolbear, quoted in our columns this week, are impatient with his tendency to let imagination outrun achievement and who virtually class him as a humbug. Mr. Tesla fools himself, if he fools anybody, when he launches forth into the dazzling theories and speculations associated with his name. That he should desire to benefit the human race in ways now unknown, and should avow out loud belief in his capacity to do so, is surely not discreditable, any more than it is unworthy in the head of his own poetic Slavic race to propose the disarmament of the world. Granted that there will still be wars, and granted that all these wonderful visions of new arts in peace do not fructify without the work of a score of later geniuses, why find fault either with the Czar or Mr. Tesla? Their aims appear wholly noble, their thoughts are beautiful, and if they fail, as they probably will in some material and vital respects, the world is certainly none the worse off for what they actually accomplish.

Just of late Mr. Tesla has been giving publicity to some of his newest work, and it is peculiarly interesting. We should have been glad, personally, to see him finish up some of the many other things that have occupied his energies these ten years past, but none of which now claim any place. For example, his "oscillator," or combination of generator and steam engine, which was to wipe out all other methods of power generation and reduce vastly the cost of power, by steam and electric economies. The very name is now bestowed by Mr. Tesla on another piece of apparatus, and though illustrated in detail and brought before the Chicago Electrical Congress in 1893, the "oscillator" of the original brand is, for aught the public knows, in the scrap heap. Yet it was a lovely invention, of infinite possibilities. We can only regret its neglect and oblivion, but if Mr. Tesla has other things more appealing to his mind for the present, that is his own business.

Of late also Mr. Tesla has brought forward another plan of power generation and transmission. At one period he expressed his belief in ability to disturb the earth's charge and thus send currents through the earth. That does not appear to be so feasible or attractive now as the idea of using the upper strata of the air which he says have a very superior conductivity. He would tether up aloft balloons in those strata and deliver to them large quantities of current at such high potential that it would travel economically across the space without wires, say from Niagara Falls to Paris. By this facile distribution of water power, coal and steam would become unnecessary to industry. The new plan may explain why Mr. Tesla has abandoned his old steam oscillator. It is earnestly to be hoped that this novel idea will prove workable. Balloons were a dismal failure in our late war, but that is no criterion, and Mr. Tesla may have some superior gas for inflation and sustentation purposes. It will be remembered that Mr. Marconi has already telegraphed from balloon to balloon, without wires, a distance of over twenty miles, thus proving in advance the tenability of Mr. Tesla's proposition.

The tremendous hold that war has taken upon the public mind is shown by the fact that even a genius of Mr. Tesla's independence is compelled to invention in that field. A patent issued to him last week intimates that he believes that torpedoes and torpedo boats, which were so utterly useless and unmanageable in the late conflict with Spain, can be made more valuable if controlled entirely from shore, by a Navy Board, and without any crew. Last spring the ability to explode floating torpedoes under ships from a distance without any wires was brilliantly demonstrated at Madison Square Garden several times a day for a month. Taking that idea, Mr. Tesla has applied the same principle to the electro-mechanical steering of torpedoes, just as it is now done with several types, but, of course, in his case, without the intervening wires from shore. He is very sanguine that this will stop war, and we pray heartily that it may. The article or patent digest we print in this issue on the subject suggests improvements of his on existing apparatus that may render it, in spite of its great delicacy, able to evade jarring and jolting, the perils of the open sea, the defensive network crinolines around the ships, the concussions of great guns, and the intentional explosion of defenses placed in its way thus to derange and negative its operation. During the late war apparatus far less sensitive than coherers was rendered useless by the firing of the heavy artillery on the ships, and it must be a preternaturally tough coherer that would escape the same fate. So also it must be a very difficult problem for which Mr. Tesla cannot suggest half a dozen diagrammatic solutions.

While all these curious things are "in the air," so to speak, it is a distinct pleasure to be able to print, as we do in this issue, Mr. Tesla's able and thoughtful paper read before the Buffalo meeting of the American Electro-Therapeutic Association. It compensates for the disappointment experienced from his unfinished lecture two years ago before the New York Academy of Sciences, which has never found its way into print, but of which the opening passages indicated the covering of the same ground. We trust that the data given by Mr. Tesla may stimulate our medical friends to greater employment of electricity. It is unfortunately true that disastrous results from injudicious use by some of them of Prof. Roentgen's great discovery of the X-ray have made medical men fight shy of handling electricity themselves lately, and we do not know whether Mr. Tesla's experiments will altogether reassure them, so striking and far-reaching are they. But the saving of human life is a sacred thing. Every means and instrumentality must be tried by the surgeon and physician, and it is devoutly to be hoped that having stopped the slaughter due to war Mr. Tesla will revert at some time to this brilliant paper and give the doctors apparatus that will help prevent the slaughter due to accident and disease.

It is not our desire to pose as apologists or publicists for Mr. Tesla. He needs no assistance of that kind; and so long as he commands freely whole pages of the Sunday papers, for which Mr. Wanamaker pays gladly his thousands of dollars, the technical and scientific journals have, indeed, little to do with the matter. All we wish to say is it is not fair to condemn, as so many do, Mr. Tesla as visionary and impractical. No man has finished his work till he is dead, and even then there are long, long centuries in which his ideas can prove themselves true. The visionaries are thus often, in the end, the most sordid of realists—something Mr. Tesla will never be.

Meeting of the American Institute of Electrical Engineers.

The 129th meeting of the American Institute of Electrical Engineers will be held at 12 West 31st street, New York City, on Wednesday, November 23, at 8 o'clock P. M. A paper will be presented by Frederick W. Carter, of London, Eng., on "The Design of Transformers."

Applications have been received from the following candidates for associate membership, which will be acted upon by the Executive Committee at its meeting December 28, 1898:

Robinson Crowell, Schenectady, N. Y.
W. N. Gladson, Fayetteville, Ark.
William B. Hodge, Philadelphia, Pa.
Francis E. Tyng, New York City.
John C. Finney, Milwaukee, Wis.
G. H. Hill, Bloomfield, N. J.
John Allan, Sydney, N. S. W.
Arthur J. Wood, New York City.
Henry B. Dates, Potsdam, N. Y.
Leo Walter, Hildburgh, N. Y.
J. J. Bellman, Ampere, N. J.
Saitaro Oi, Tokyo, Japan.
Lincoln S. Risley, New Britain, Conn.

ELECTRIC ROADS NEEDED IN PORTO RICO.

Gen. Roy Stone, United States Volunteers, who recently returned to Washington from Porto Rico, where besides fighting with his troops he made a very thorough investigation of the roads on the island. He is reported in a Washington dispatch to the *Sun* as saying:

"I am convinced that Porto Rico will never have a complete system of wagon roads such as some of the States have. Roads are enormously expensive in that island, the celebrated military road costing in the neighborhood of $100,000 per mile. The enormous rainfall distributed throughout all seasons is ruinous to any road unless thoroughly well drained and constructed on a hard foundation. I believe, however, that the place of the wagon roads will be more than filled by electric roads, of which I am certain there will soon be a network over the island. Steam railways would be too expensive to construct or to operate, there being no coal on the island, while there is an abundance of water power. The rivers rise in the mountains in the interior and have an average fall of 2,500 feet in their short race to the sea, and there is always abundance of water pouring over high falls. Power for electric roads could be obtained from these falls at little expense, the roads could be easily graded and the rain would not affect an electric road as it does a wagon road. These roads would open communication between the interior and the coast and place the coffee, sugar and tobacco of the plantations within easy access of the seaboard. I regard the possibilities for the investment of American capital in Porto Rico as something immense. Porto Rico is destined to outstrip Cuba in the next few years. In addition to having a more stable government its climate is better, its people more peaceable and better workmen, and its soil fully as fertile. The Porto Rican laborer resembles the Italian of the same class. He is cheerful, industrious and economical, and his labor is very cheap, about one-fourth that of an American laborer. This is explained by the fact that food and clothing cost but very little on the island. The laborer lives on the fruit of the banana tree, which also furnishes partly his clothing and housing. He needs little furniture and little clothes. The educated natives are a high class of people, cultivated, polite, and compare favorably with the higher classes in the States. The lower classes are capable and willing to learn. They are all very friendly, and almost every one on the island is attempting to learn English. They are especially desirous of having American schools established or having the English language taught in the schools.

"With cheap labor and free access to American markets, railroad facilities and plantations owned and operated by Americans, I fail to see anything but a brilliant future for the island. The sugar, coffee and tobacco, the banana and cocoanut plantations, electric railroads and paper making are all good enterprises in which capital can be properly invested. There is little doubt that in a few years Porto Rico will be the winter resort of America. Its climate is equal to that of Florida or Cuba in the winter time, its atmosphere more healthful and its scenery far more varied and interesting. In addition to all the tropical luxury of vegetation, Porto Rico has high mountains, beautiful valleys, splendid waterfalls and beautiful views. As the electric roads open up communication with the interior it will be possible for the tourist to visit all the show places of the island at his ease, and with American hotels or boarding houses scattered over the island he can always get good accommodations. Within a year there will be a number of fine hotels at San Juan and Ponce and preparations made for the influx of winter tourists."

In conclusion, Gen. Stone said that owing to the density of the population of Porto Rico and the cheapness of living, it would be a long time before wages reached the American scale, but as the demand for Porto Rican products increased, the demand for labor there would advance the price of it, and gradually, as the laborer became accustomed to the comforts of the American laborer, he would need more and receive more. He believes that matters in Cuba will be unsettled for several years at least, during which time he thinks the conservative American capitalists will invest their money in Porto Rico rather than in Cuba. Gen. Stone will make a report on the result of his inquiry to the Secretary of War.

New York Electrical Society.

The 191st meeting of the New York Electrical Society was held on Thursday evening, November 17, at the College of the City of New York. An interesting and lengthy paper was presented by Mr. E. H. Johnson, entitled "Surface Contact Railways, with special reference to the Johnson-Lundell System." The meeting was unusually well attended. The following is a list of new members elected at the business meeting of the Society:

Prof. J. Burkitt Webb, Stevens Institute, Hoboken, N. J.
Hubert Greaves Webb, Glen Ridge, N. J.
Henry V. Parsell, New York.
Joseph White Stickney, Brooklyn, N. Y.
August Treadwell, Jr., Electric Storage Battery Co., New York.
Morton Arendt, New York.
W. G. Burns, New York.
Theo. H. Joseph, New York.
Bernhardt Hoffman, N. Y. Telephone Co., New York.
W. I. Thompson, Newark, N. J.
Frank R. Wainwright, Chesley Electric Co., New York.
Thomas J. Buckley, Tenafly, N. J.
St. John P. Chilton, New York.
William Newton Ryerson, Montclair, N. J.
Thomas J. Fay, Electrical Engineer School of Correspondence, New York.
J. E. Woodbridge, Editor *Electrical World*, New York.
Charles E. Dustin, Excelsior Electric Co., Brooklyn, N. Y.
Henry B. Cutter, Philadelphia, Pa.
Alexander McGill, New York.
Charles T. Child, Electrical Editor *Engineering Magazine*, New York.
Lieutenant W. D. Weaver, *American Electrician*, New York.
Dr. Louis Duncan, Empire Building, New York.
A. E. Clifford, *American Electrician*, New York.
A. Stamm, Chesley Electric Co., Hoboken, N. J.
V. C. Gilpin, Cutter Electric & Mfg. Co., New York.

LEGAL NOTES.

An injunction has been issued by Judge Tuthill of the Circuit Court at Chicago, at the instance of the former stockholders of the Merchants' Arc Light & Power Company, restraining the Chicago Edison Company and Samuel Insull, its president, from proceeding further in paying William H. Collins, secretary of the Merchants' Company, for the stock of that company, alleged to have been purchased by the parties enjoined. The order of the court also forbids William H. Collins from disposing of or in any way incumbering the money and contracts already received by him in the sale till the further order of the court. At a meeting in January, 1898, it is said, some of the stockholders of the Merchants' Company declared their willingness to sell their stock for $15.40 per share of the par value of $100. Collins, it is declared, told the shareholders that such a price might be obtained if the entire stock of the concern were placed upon the market, and agreed to find a purchaser. In April, the shareholders say, they were informed by Collins that he had a buyer, and they accordingly relinquished their shares on the receipt of $15.40 per share. Since the sale the shareholders assert they have discovered that a much higher price was obtained by Collins for the stock than he led them to believe was possible. The claim of the petitioners now is that Collins received $25,000 for the stock, or about $72 per share.

The Marks Enclosed Arc Light Company has been granted a perpetual injunction in the United States Circuit Court at New York, restraining the Electric Construction & Supply Company from further infringing the former company's patent for an improvement in arc lights. The order of the court decrees that the Marks Light Company owns the exclusive right to United States letters patent No. 520,996, granted to Louis B. Marks and Clarence Ransom, in June, 1894, and that the defendant company has infringed that patent by making and selling lamps similar to those made by the plaintiff, and known as the "Kinsman," the "Kinsman 150 hour lamp," and the "Kinsman long burning arc lamp."

Justice Collins filed an opinion in the Supreme Court at Trenton, N. J., last week which sustains a verdict for damages secured in the Essex Circuit against the Newark Electric Light & Power Company, on account of Thomas J. Ruddick, an 8-year-old child, who was injured by taking hold of a live wire that was trailing on the street. The case was carried to the Supreme Court on an exception to the refusal of the trial Judge to grant a non-suit. The non-suit was asked for on the ground that there had been no negligence on the part of the company, that the wire had been down but a few minutes. Justice Collins's opinion holds that the length of time the wire was down does not enter into the case, and the company did not avail itself of the opportunity to prove that the breaking of the wire was due solely to the elements and not within the company's power to prevent.

Papers were filed in the office of the clerk of the United States Circuit Court at Brooklyn, N. Y., on the 18th inst. by the Thomson-Houston Electric Company in an action against the Nassau Electric Railroad Company to enjoin the latter company from using a certain electric commutator or switch and also for the appointment of a commission to determine damages from alleged unlawful use of the switches.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING.

Camden, N. J.—The Lighting Committee of the council met on the evening of the 16th inst. to open bids and award contracts for lighting the city with arc and incandescent electric lights from July 1, 1899. Previous to opening the bids an order was read from Judge Garrison, citing the members of the council to appear before him on November 26, and show cause why a writ of certiorari should not be granted, reviewing the action of council in granting a franchise to the Citizens' Light, Heat & Power Company, that company having put in a bid. The rule was granted in a suit of John M. Kelly and others, representing the Camden Lighting & Heating Company.

Kazabazua, Can.—A joint stock company is to be formed shortly to establish an electric light plant here. The company will put in lights at a very low figure in order to encourage the residents to patronize this new enterprise.

Kissimmee, Fla.—J. M. Bailey having proposed to the council to put in an electric lighting plant in this place, that body has decided to call a special election for the purpose of voting on the proposition of granting a ten-year exclusive franchise to Mr. Bailey for lighting the town.

Kokomo, Ind.—The electric light plant of the Citizens' Light & Power Company of this city was sold at receiver's sale on the 12th inst., Woodruff & Stevens of Detroit being the purchasers. They are the principal owners of the Kokomo Street Railway Company. The price paid was $24,000. The plant cost $70,000.

Louisville, Ky.—An electric light plant is to be placed on the steamer Kate Adams, the first of the kind put on a steamboat on the Ohio.

Newton, Kan.—The plant and franchise of the Newton Light & Power Company have been purchased by a company which will be known as the Gas & Electric Company of Newton. The institution is now entirely in the control of Newton parties. The officers are: Don Kinney, president; John C. Nicholson, vice-president

and treasurer; James D. Nicholson, secretary. The plant will be improved and enlarged.

Ogdensburg, N. Y.—An electric light plant is to be erected at St. Regis Falls if the residents agree to take lights enough to warrant the undertaking. A canvass is being made to determine this question.

Omaha, Neb.—The J. C. Hubinger Company of Keokuk, Ia., has made application to the city council for an ordinance granting it the right to maintain and operate a steam heating plant and an electric light and gas plant in Omaha. The company offers, if the ordinance is granted, to furnish the city offices with steam heat and incandescent light free of charge, the lights to be burned such hours as would be agreed upon between the company and the city.

Providence, R. I.—The enclosed arc lamp is rapidly coming into use in the large dry goods stores of this city; in one store here 124 enclosed arc lamps are distributed throughout the different departments. The light given is described by the "Providence Journal" as the most satisfactory substitute for sunlight in millinery and fine dress goods departments that has ever been brought to the attention of the users. The lamps are very cleanly and reliable in operation, do not scatter carbon dust, are ornamental in appearance and give an evenly diffused light.

Salem, Mass.—The Salem Electric Lighting Company is adding to its plant two Edison bi polar generators, each of a capacity of 2,000 lights of 16 candle-power. This addition is made to meet the increased demand for light and power.

Sarcoxie, Mo.—The Sarcoxie Electric Company has been organized to build an electric light plant.

Savannah, Ga.—The probability is that Savannah will soon have two underground electric lighting systems. The holding up of the new Edison Illuminating Company's ordinance for the purpose of considering that of the Brush Company at the same time, is understood to mean that both will be treated alike. The Brush Company has been contemplating establishing the underground system for some time.

Schaghticoke, N. Y.—The board of trustees has granted the Valley Electric Light Company the privilege of erecting poles and stringing wires throughout the village for electric lighting purposes.

Schuylkill Haven, Pa.—An explosion at the borough electric plant on the 12th inst. badly damaged the dynamos and other machinery, and left the town in darkness.

Sturgis, Mich.—The question of erecting a municipal lighting plant was decided in the affirmative at a special election held here on the 11th inst.

St. Paul, Minn.—The specifications for street lighting submitted by the board of public works to the council committee on streets provide for the lighting during 1899 of electric arc, gas and gasoline street lamps and for public buildings. The specifications provide for 375 electric arc street lamps, which is an increase of 118, there being 257 now in use. The company securing the electric lighting contract, according to the specifications, will be awarded a franchise to do a commercial business for ten years within the district covered by its contract. This question will be thoroughly discussed by the council and may be materially changed, as it is understood there is some opposition to it.

Thibodaux, La.—The proposition providing for an extra tax to establish and maintain an electric light plant was carried at the recent election by a large majority.

Urbana, O.—The electric light plant in this city, heretofore owned by Chicago capital, has been purchased by a new local company of which Frank Chance is president and John C. Powers secretary and treasurer.

Warrens, Wis.—The George Warren Company has decided to put in an electric plant here for public and private lighting, and with that object in view has invited Mr. Benton, an electric light expert from La Crosse, to come and submit a proposition to furnish and install the plant.

STREET RAILWAYS.

Bennington, Vt.—A bill consolidating the Bennington Electric Railroad Company and the Hoosick Electric Railway Company has passed both branches of the Vermont Legislature. The two roads have, however, practically been consolidated for some time past.

Belfast, Me.—The building of an electric road from this city to Northport is being agitated anew, and with some prospect of the scheme being carried out. A charter for the road, secured some six years ago, has been renewed from time to time, and is held by the original incorporators. These are Charles B. Heseltine, president of the Belfast & Moosehead Lake Railroad; William B. Swan, ex-mayor of Belfast; Asa A. Howes, a prominent merchant and director in many corporations; Dr. John G. Brooks, president of the Belfast National Bank; N. F. Houston, president of the Savings Bank; John H. Quimby, cashier of the Savings Bank; James H. Howes, a prominent business man; Hon. E. K. O'Brien of Thomaston; Hon. H. L. Shepherd and his brother Edward of Rockport.

Burlington, Vt.—The contract for the construction of the electric railway between this city and Hinesburg has been let to C. W. Blakeslee & Sons. The road is to be 15 miles long and will be used for freight as well as passenger traffic.

El Paso, Tex.—An ordinance has been adopted by the city council granting to B. F. Hammett, Moses Dillon and associates a franchise to construct, maintain and operate lines of electric street railway in this city and to establish an electric plant for the purpose of furnishing light, heat and power. The term of the franchise is fifty years. The grantees are required to put up a forfeit of $10,000 to have both plants complete and in operation within two years from the date of the deposit.

Hackensack, N. J.—The Bergen Traction Company will not be able to reach Hackensack this winter, owing to the fact that permission from Congress must first be obtained before a bridge can be built across the Hackensack river near the spot in Hackensack where the company purposed making its terminal. The grading of the remainder of the road is completed from Leonia to Bogota.

Houghton, Mich.—The village council has voted to give a franchise for a street railway to William H. Taylor of New York, provided he can secure franchises from other towns so as to build a belt line about the county, connecting Houghton, Hancock, Quincy, Franklin, Dollar Bay, Lake Linden, Laurium, Calumet and Red Jacket. The proposed line will be twenty miles long.

Kittanning, Pa.—F. A. Maesta is president of the company which is building the electric road between Ford City and Kittanning.

Jersey City, N. J.—The North Jersey Street Railway Company has arranged for a new trolley line extending from Communipaw avenue to a point near the boundary between Greenville and Bayonne, where it will intersect the company's main line. The line will be a great convenience to people living in the southern section of Jersey City.

Lewiston, Me.—The controlling interest in the Lewiston, Brunswick & Bath Street Railway has passed into new hands at a cost of nearly half a million dollars.

Lexington, Ky.—A company is being formed in this city to build an electric railway between Lexington and Richmond, Ky., 22 miles. The principal promoters are W. J. Loughbridge, vice-president of the Electric Street Railroad Company, and Dr. Bennett, president of the National Exchange Bank. The road will cost $125,000 and will cross the Kentucky River at Clay's Ferry.

Miami, Fla.—There is a movement on foot for the building of an electric railway from Miami south to Cutler and north to Lemon City.

Needham, Mass.—The selectmen have granted a franchise to the Needham & Boston Electric Railway Company to lay tracks and operate a line of electric street cars between Postoffice square, Needham, and the Dedham town line, via Great Plain, Dedham and Harris avenues. The company proposes to connect at Spring street with the West Roxbury and Roslindale company and will give a 10-cent fare to Boston.

Owosso, Mich.—Eastern capitalists and local owners of the road and power plant of the Owosso & Corunna Traction Company are planning to extend their road to this city from Flint, extending the electric lines running west of Detroit to the Pontiac and Sylvan road. Grand Rapids and Chicago capitalists are also endeavoring to secure the property to construct lines through to Grand Rapids and Lansing. This will make Owosso the center of all the electric roads in this part of the State. The capital interested is $400,000.

Pine Bluff, Ark.—A committee of citizens is securing subscriptions here for an electric car line and lighting plant on a plan submitted by Henry C. Wood, representing the Westinghouse Company. The subscription proposes a company capitalized in the sum of $300,000 with $200,000 subscribed in bonds, the par value of each being $1,000; sixty, with a par value of $500 each; 200 with a par value of $100 each. It is proposed to have assigned to the company the franchise granted to Nat Covington and Wilbur C. Harrison, and to have as officers of the company Col. S. W. Fordyce president, the vice-president, secretary and treasurer to be citizens of Pine Bluff.

Rochester, N. Y.—The directors of the Rochester & Irondequoit Railroad Company, better known as the Bay Railroad, have decided to lay double tracks over their road and to equip it with electric cars before another summer season opens.

Rockland, Mass.—Pepper & Register of Philadelphia, who recently came into possession of the Rockland & Abington Street Railway, have obtained a controlling interest in the Bridgewater, Whitman & Rockland line. It is said that Pepper & Register are leaders in a project for amalgamating all the street car lines in Southeastern Massachusetts.

Rockaway, L. I.—The Queens Borough Electric Light & Power Company is erecting a big power house at Far Rockaway for the purpose of supplying power for the operation of a trolley line running the whole length of the Rockaway peninsula for which franchises have already been secured. This line, it is said, is intended as a feeder for the Long Island Railroad, and will connect with the Brooklyn Elevated at Woodhaven. The plant will be equipped to furnish light as well as power, and the company proposes to erect docks and a coal elevator in connection with the power house. Van Wyck Rossiter is president of the company and R. C. Peabody vice-president.

Salem, N. Y.—J. S. Powers of Lansingburg has surveyors at work examining a route for an electric road from Schuylerville to Salem via Greenwich and East Greenwich.

Sidney, N. Y.—The name of the Delaware Terminal Company has been changed to Delaware Electric Light & Power Company. The company has a large force at work on their trolley road which is to connect this place with Franklin. The power house will be erected midway between Franklin and Sidney.

South Bethlehem, Pa.—Capitalists are securing the right of way for an electric road from here to Nazareth, a distance of eight miles. After this line is completed the road will be extended twelve miles to Wind Gap, Penn Argyl and Bangor, and from there another twelve miles to Portland and Delaware Water Gap. The railway which connects South Bethlehem with Hellertown will be extended to Quakertown, and the line from Quakertown to Doylestown will be completed. The near future will therefore see direct communication by electric railway between Philadelphia and the Delaware Water Gap, a distance of about eighty miles.

St. Louis.—The bond of $50,000 of the Lindell Railway Company to secure the franchise extension recently granted the company by the municipal assembly has been approved by the council. The sureties on the bond are Edwards Whitaker, Charles D. McLure, Henry D. Haarstick and S. M. Dodd.

Washington, D. C.—The Belt Railway was bought at public auction on the 15th inst. by Oscar T. Crosby for $350,000. The sale includes the franchises, real estate, rolling and live stock of the old company. An underground electric system must be installed within one year from the date of the ratification of the sale by the court.

Zanesville, O.—It is learned from what is deemed a reliable source that the Zanesville Street Railway & Electric Light Company will be taken out of the receiver's hands and the company reorganized in a short time.

MANUFACTURING, ETC.

Ansonia, Conn.—The Russell-Tomlinson Electrical Company, manufacturers of electrical specialties and novelties, has reorganized under the same name, with an increase in capital stock from $10,000 to $17,000 in shares of $100. The officers of the new company are: President and general manager, William Russell; vice-president, William Tomlinson; secretary, George G. Milne. The company will purchase an entire new outfit of machinery and double the size of the factory.

Fort Wayne, Ind.—A rumor having got abroad here that the Fort Wayne Electric Corporation was to enter the electrical combination formed by the Westinghouse and General Electric companies, President R. T. McDonald was questioned in regard to the matter and replied: "No, there is nothing in it at present, but one can't say what might happen in the future. It is true that the corporation has been talking for some time past of raising money with which to erect additional buildings, but I do not know that that should have started the report. We need more room here and want to build some additions as soon as we can manage it."

POWER AND TRANSMISSION PLANTS.

East Helena, Mont.—The smelter plant here is now being operated by electricity transmitted from the Canyon Ferry electrical plant. It is related as an evidence of the promptness with which the work was done when everything was made ready that the blast furnaces were shut down but four hours while the steam power was being cut out and the electricity installed. There are a number of motors, two of 175 horse-power each, and three of 100 horse-power, one of 50 horse-power, one of 30 horse-power and one of 20 horse-power.

Grand Rapids, Mich.—The Newaygo Transmission Company has been organized by local capitalists, with $15,000 capital, to develop the water power at Newaygo, thirty miles north of here, and to transmit electric power to this city. The company has been given a franchise to erect poles and string wires in this city. A. C. Sekell and Charles F. Pike are the chief promoters of the enterprise.

Lindsay, Can.—Some time ago Messrs. Culverwell & White-Fraser of Toronto undertook to form a company and transmit power from Fenelon Falls to Lindsay, but could not carry out the undertaking. The matter has been taken up by some of the citizens, with A. E. Ames of Toronto. An electrical expert is to be employed to look into the matter, and if the scheme is endorsed by him and a certain amount of stock taken by the citizens, Mr. Ames will undertake to secure the necessary capital to carry the scheme through.

Niagara Falls, N. Y.—Officials of the Niagara Falls Power Company say that they have had more applications and inquiries for power in the last month which really look like business than they have ever had in an equal period. Many Eastern manufacturers and others are writing to them and visiting them in relation to power. The company has closed some large contracts recently and expects to do plenty of business. The Carter-Crume Carbide Works with triple its present plant and another concern that will use a large amount of power will employ 400 hands. Its factory will be situated near Echota. Other large concerns are negotiating for power.

North Tonawanda, N. Y.—A new power house is to be built here for converting and supplying Niagara Falls power to manufacturers and to the Buffalo & Lockport Railway Company. The machines which will be installed when the building is finished will be principally transformers and converters similar to the

big machines now in operation in the Lockport power house of the Buffalo & Lockport Railway.

St. Cathaiines, Can.—The formal opening of the Cataract Power Company's plant at De Cew's Falls took place on the 12th inst. The works were inspected by about 160 guests, including members of Parliament, editors, engineers, etc., from Hamilton, Toronto and elsewhere. The water for the power house at De Cew's Falls is taken from the Lake Erie level of the Welland Canal at Allanburg. It is brought through the company's private canal four and a half miles to the top of the mountain, where it is stored in three immense reservoirs, covering about 35 acres. The water is conveyed from the reservoirs to the power house at the foot of the hill by a huge steel pipe, eight feet six inches in diameter and 750 feet long. The water falls 270 feet into the power house, where the big steel pipe is divided into four branches. To two of these branches horizontal turbines of 2,000 horse power each are attached. The turbines are connected with 1,500 horse power electric generators by leather links instead of a belt. The total capacity now is 3,000 horse power, but connections are left ready so that the capacity can be doubled at any time.

COMPANY MATTERS.

Boston, Mass.—The Massachusetts Electric Freight Company, through James Means, A. M. Howe and Andrew Fiske, of this city, has filed a petition for incorporation by the incoming Legislature, and with authority to make contracts with existing electric lines to carry freight.

Charleston, W. Va.—The New York Wharf & Warehouse Company of Brooklyn, N. Y., has secured a charter here, empowering it to construct and operate elevated railways, motor-cars, docks, wharves, warehouses, piers, manufacture and supply gas and electricity, operate lines of telephone and telegraph, maintain ferries between New York City and Yonkers and points in New Jersey, etc. Capital subscribed, $50,000, with the privilege of increasing the same to $500,000 in all. The shares are $100 each, and are held by Stephen M. Hoyt, William W. Fish, John McDowell, Charles H. Friganza and William Meserole of Brooklyn, N. Y.

New York.—H. B. Coho & Co., dealers in electrical supplies, formerly at No. 30 Cortlandt street, called a meeting of their creditors at No. 143 Liberty street on the 18th inst. About 75 per cent. of the creditors attended. The liabilities are $60,000, and assets estimated at $40,000. A committee of five creditors was appointed to wind up their affairs, collect the outstanding accounts and divide the proceeds pro rata among the creditors. The committee consists of representatives of the Eddy Manufacturing Co., Oswego Boiler Works, Marietta Manufacturing Co., the City Bank of Hartford and the Harrisburg Foundry & Machine Works. The business was started in 1884 by Herbert B. Coho and the "Co" was Geo. C. Hoffman. Mr. Coho has obtained an injunction restraining Mr. Hoffman from disposing of the property of the firm, collecting any money and compromising any claim due the firm.

PERSONAL AND MISCELLANEA.

The substitution of electricity for horse traction on one of the large canals in England is viewed with much interest, for there can be no doubt that the full utility of these inland waterways is not realized, largely owing to the cost of traction and the increased toll consequent on their inability to compete in this respect with railways. There are 4,000 miles of canals in England, and but an indifferent attempt has been made to supersede horses by steam propeller boats, as in Scotland.

A curious state of things was observed in investigating the electrolysis of water pipes in Dayton, O., in which it was found that stones and pebbles near the pipes in some cases seem to have been electroplated with the metal of the pipe, a circumstance which one of the experts believes has never been observed before.

RECENT COMPANY ELECTIONS.

Bristol & Plainville Tramway Company, Bristol, Conn.—President, C. S. Treadway; vice-president, N. E. Pierce; secretary, H. J. Muzzy; treasurer, M. L. Tiffany; directors: M. L. Peck, O. F. Strunz, W. S. Ingraham, W. A. Ingraham, N. E. Pierce, E. N. Pierce and J. H. Sessions.

Emmitsburg Railroad Company, Emmitsburg, Md.—President, William A. Hines; vice-president, Rev. William L. O'Hara, president of Mt. St. Mary's College.

Merchantville Light, Heat & Power Company, Merchantville, N. J.—Directors: F. A. Downes, F. J. Burr, W. N. MacCallum, E. S. Hall, George W. Algor, E. T. W. MacCallum, George P. Williams, F. C. Robbins and William Griffiths.

Peoria General Electric Company, Peoria, Ill.—President, Peter Coffey; vice-president, Philip Zell; treasurer, Martin Kingman; secretary, Matthew Farrelly; directors: Leslie Robison, Matthew Farrelly, Julius Schwabacher and the officers.

United States Electric Lighting Company, Washington, D. C. Directors: A. A. Thomas, Stilson Hutchins, Seymour W. Tullock, Walter Hieston, W. A. Mearns, James L. Norris, George W. Pearson, Charles C. Duncannon, Clarence F. Norment, John Cammack, S. J. Butterfield, W. H. Slater and Charles Werner; all re-elected except W. A. Mearns and Walter Hieston, who take the places of Geo. W. Gray and Dr. Thomas O. Hills. James L. Norris has been elected president of the company.

Urbana Electric Light & Power Company, Urbana, O.—President, Frank Chance; vice-president, Charles H. Ganson; secretary and treasurer, John C. Powers; superintendent, Frank E. Valentine; directors: the officers and George W. Hitt.

COMMERCIAL PARAGRAPHS.

Alternating Currents and Transformers.

The Lakon Company of Elkhart, Ind., has published a booklet entitled "The Lakon—A Book for the Busy Man on Alternating Currents and Transformers." A unique

LAKON COMPANY'S $7\frac{1}{2}$ K. W. TRANSFORMER.

feature of this booklet is a description of the principles of alternating currents, with special reference to their application to transformers. The book describes the new line of transformers which this company has recently placed upon the market. These transformers are of the oil type, and although they may be used without oil the company strongly advise the use of oil in all sizes, as the oil aids in the dissipation of heat and prevents deterioration of insulation due to high temperatures. A pair of very strong and simple all porcelain fuse boxes are furnished with each transformer.

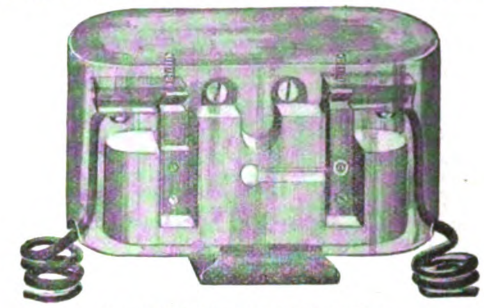
The method of hanging is extremely simple. It is with extreme ease and facility that the light Lakon hanging hook can be held in position and lag screws and bolts put in place by one man, and when the transformer is hoisted to be hung upon the hook it can be swung into position and quickly and easily lowered into the hanging hook.

A transformer having a high full load efficiency will not necessarily have a high all-day efficiency, and it is the all-day efficiency which is important. In order to secure a high all-day efficiency the transformers have been designed for a very low core loss, and good regulation is secured by a symmetrical arrangement of the windings and a liberal use of copper. The primary and secondary cables are brought out on opposite sides of the case through heavy porcelain bushings and are firmly cemented into the porcelains, so that there will be no chafing or wearing away of the insulation where the cables come through the case.

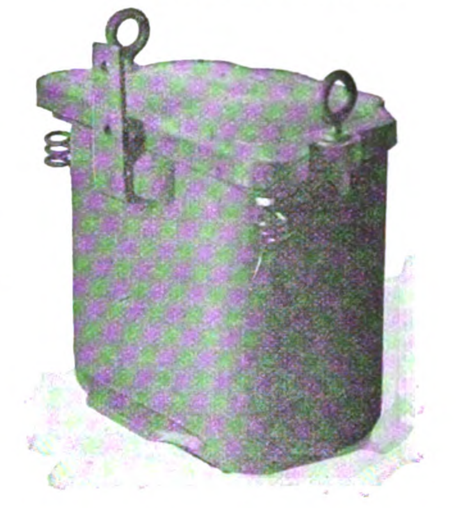
The aging of iron has been investigated by this company and they will replace within two years any transformers that will show any marked change in efficiency due to aging of iron.

In the Lakon transformer the coils are so arranged that a very large surface of copper is exposed to the oil so that the temperature is kept down to a very low figure.

The transformers are designed to withstand a very high break-down test between primary and secondary and between primary and core. While a very high insulation between primary and secondary is a safeguard against burn-outs from lightning, a transformer cannot be made in which the insulation in itself is enough to withstand the extremely high potential of a lightning discharge, and the company advocates a more general use of lightning arresters. Metallic ground shields will be placed in transformers when specified, but they do not advise the use of them on account of the increased danger of a puncture in

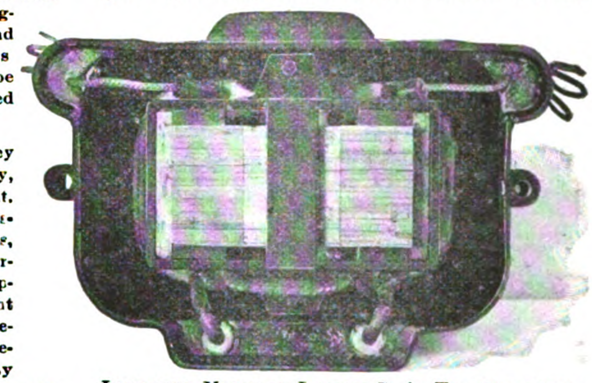


LAKON COMPANY'S FUSE BOX.



REAR OF CASE SHOWING LAKON COMPANY'S HANGING DEVICE.

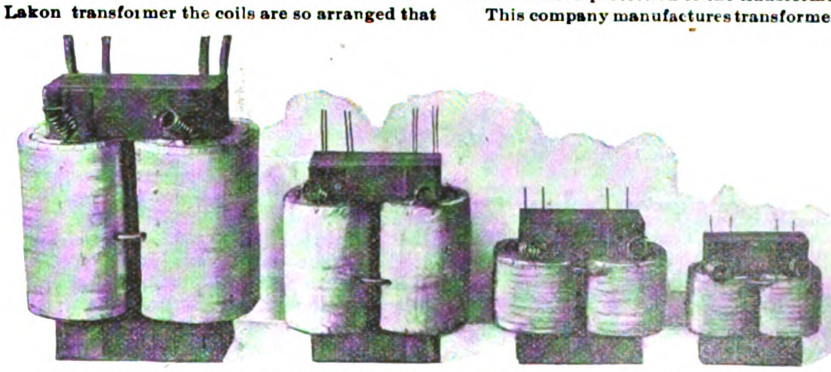
the insulation due to a lightning discharge. The ground shield being connected to earth affords a free path for lightning, and they believe that the transformer is more



INTERIOR VIEW OF LAKON CO.'S TRANSFORMER.

liable to be burned out by lightning when ground shields are attached. The ground shield will prevent the lightning discharge from appearing on the secondary circuit, but it is not a protection to the transformer.

This company manufactures transformers for alternating current arc lamps, step-up and step-down transformers, and transformers for special purposes, such as electrocautery, electric welding or testing purposes.



LAKON COMPANY'S $7\frac{1}{2}$ K. W., 4 K. W., $1\frac{1}{2}$ K. W. AND $\frac{1}{2}$ K. W. TRANSFORMERS.

INCORPORATIONS.

The Cincinnati, Lawrenceburg & Aurora Electric Street Railway Company, Aurora, Ind. Capital stock, $10,000.

The Gregory Electric Company, Chicago, Ill. Capital stock, $100 000. Incorporators: C. A. Gregory, G. A. Fargher and G. K. Wadsworth.

The Rocky Ford Electric Company, Pueblo, Col.—to build and operate a general electric plant in Rocky Ford. Capital stock, $15,000 Incorporators and directors: J. B. Downey, F. A. Kittler and F. L. Cuddeback.

The American Engineering Company, Camden, N. J.—to construct and equip railroads or railways, electric light, gas and other plants. Capital stock, $100,000; amount paid in, $1,000. Incorporators: Samuel B. Vrooman, Nathan Cox and John B. McAfee of Philadelphia, Pa.; John H. Tunstall of Camden.

The Electric Motor & Equipment Company, Newark, N. J.—to deal in, operate, manufacture and repair electric motors and electric machinery. Capital stock, $100,000. Incorporators: Augustus J. Miller, Joseph G. Ward, Jr., and Frederick G. Agens, Jr., of Newark.

The Newtown Alliance Company of New York City—to manufacture electrical supplies. Capital stock, $25 000. Directors: James A. Stiles, Hempstead; David E. Drake and Louis Beck, Newark, N. J.; Charles L. Eidlitz and Benjamin F. Hamilton, New York City.

The Fort George Extension Railway Company, New York City—to build and operate an electrical surface road from 172d to 185th street on Eleventh avenue, New York. Capital stock, $10,000. directors: M. G. Starrett, W. P. Plummer, John Lambdon, Andrew Loughlin, D. W. Patterson and Harry Hartwell of New York City, John Kerr and Charles E. Corby of Brooklyn, and H. A. Himely of Far Rockaway.

The Holbrook Land & Water Company, Provo, Utah—to acquire, cultivate and dispose of lands, construct and acquire reservoirs for impounding water, canals, aqueducts, conduits, flumes, pipes, ditches, dams and other things necessary to impound, control and distribute waters for irrigation, domestic and power purposes, including the erection and maintenance of electrical transmission lines and systems. Capital stock, $300,000. Incorporators and directors: Lafayette Holbrook (president), Emily A. Holbrook, B. S. Hinkley (secretary and treasurer), all of Provo; James A. Melville (vice-president), and Joseph E. Ray, of Fillmore.

ELECTRICAL PATENT RECORD.

Letters Patent Issued November 15, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

614,082. Intermittent Electric Surface Conductor. Frank Burger, Fort Wayne, Ind., assignor of three-fourths to Henry M. Williams, same place. Filed July 23, 1897.

614,124. Electric Switch Mechanism for Electric Railways. John M. Murphy, Torrington, Conn., assignor of two-thirds to David F. Halstead, New York City, and William M. Keepers, Newark, N. J. Filed Sept. 3, 1897.

614,133. Switch-shifting Mechanism for Electric Cars. Jeremiah P. W. Roach, Concord, N. H. Filed Feb. 1, 1898.

614,161. Electric-Car Truck. Edward Oliff, Newark, N. J. Filed Aug. 24, 1898.

614,208. Trolley. Francis A. Le Court, Rockport, Mass. Filed June 17, 1898.

614,321. Trolley-Controller. John Dolan, Dayton, Ohio. Filed April 23, 1898.

614,412. Electric Switch-Operating Mechanism for Railways. Louis E. Walkins, Springfield, Mass., assignor of one-half to George M. Jewett, Glenville, Md. Filed Sept. 7, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

614,318. Portable Electric Lamp. Owen T. Bugg, Jr., New York City. Filed March 15, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

614,076. Alternating-Current Motor and Mode of Operating Same. Charles S. Bradley, Avon, N. Y., assignor to the General Electric Company of New York. Filed June 22, 1895.

614,225. Electric Meter. Ludwig Gutmann, Peoria, Ill. Filed Dec. 4, 1897.

614,573. Arrangement for Exciting Magnets of Dynamo-Machines. Max Deri, Vienna, Austria-Hungary. Filed July 27, 1898.

614,394. Starting Resistance for Alternating-Current Motors. Ernst L. K. F. Kahlenberg, Berlin, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Dec. 30, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

614,207. Telephone-Exchange System. William E. M. Jackson, Chicago, Ill. Filed Jan. 14, 1896.

BATTERIES.

614,228. Method of Charging Secondary Batteries. Cyprien O. Mailloux, New York City. Filed April 24, 1891.

614,339. Electric Accumulator. Frederico Pescetto, Turin, Italy. Filed Dec. 24, 1897.

MISCELLANEOUS.

614,190. Magnetic Chuck. Oakley S. Walker, Worcester, Mass. Filed March 11, 1897.

614,240. Traction-Dynamometer. Edward A. Uehling, Newark, N. J. Filed Oct. 15, 1897.

614,270. Insulated Supporter for Electric or Other Wires. Charles K. King and George A. Mead, Mansfield, Ohio; said Mead assignor to the Ohio Brass Company of Ohio. Filed June 29, 1898.

614,288. Thermostat. Edward Cary, New York City, assignor to Alice Gilbert and Charity Cary, same place. Filed Sept. 16, 1897.

614,401. Signaling Apparatus. Morris Martin, Malden, Mass., assignor, by mesne assignments, to F. Benedict Herzog, New York City. Filed Sept. 28, 1885.

DESIGN.

29,682. Drop for Use in Electrical Warp Stop-Motions. William H. Baker, Central Falls, R. I., and Frederic E. Kip, Montclair, N. J. Filed Oct. 25, 1898.

TELEPHONE AND TELEGRAPH.

Chief Hale of the Kansas City, Mo., Fire Department has invented an electric fire alarm which is claimed to be superior to the systems now in use. As described in the Kansas City *Journal*, "the apparatus is a combination of the telephone and the graphophone, so arranged as to work automatically. The idea is to place thermostats at frequent intervals about the various rooms of a building and connect them by wires to a graphophone which is connected with the business telephone of the house. The wires from all the thermostats on any one floor run to a reproducer which is poised above a wax cylinder in which record has been made. The thermostats on the next floor are connected with a reproducer poised over another line. And so on for all the floors of the building. The thermostats are so sensitive that a very little increase in the heat in the room, such as would be made by a fire in any portion of it, breaks the electric circuit. This lets the reproducer for that particular floor drop upon its proper wax cylinder, and the graphophone begins repeating its alarm into a telephone transmitter connected with the central office which notifies the fire department."

An ordinance has been introduced in the city council of Columbus, O., granting a 25-year franchise to the Ohio Telephone Company to operate in that city. According to the provisions of the ordinance the company is to allow the use of its poles for the police and fire-alarm telephone systems, furnish 75 telephones free of cost to the city and pay an annual rental of 1 per cent. on the gross receipts of the company on the first $100,000, 2 per cent. on the gross receipts over $150,000 and 3 per cent. on the gross receipts over $200,000. The rentals fixed by the ordinance are $3 a month for residences, $4 a month for business houses, unless the company places its lines in a conduit, when the right is reserved to add to the price not to exceed $1 per month The percentage is to be assessed on the gross receipts as made out in an affidavit by the president or superintendent of the company on or before January 15 of each year and paid into the general expense fund.

The Automatic Telephone Company of New Bedford has been organized in New Bedford, under the laws of Massachusetts. The capital stock is $100,000, par value of shares $50. Thirty prominent business men of New Bedford are the incorporators, who have elected the following officers and directors: President, John W. Macomber; vice-president, F. T. Akin; treasurer, Frederick Taber; clerk, Arthur R. Perry; directors, the above and B. F. Brownell, Lot B. Bates, Frank R. Kirby, Jos. Poisson and J. L. Gillingham. The company proposes to construct a first-class underground telephone system, with private metallic circuits for each subscriber, and long distance instruments, as soon as 500 subscribers have been obtained; 400 have already been secured.

A Boston exchange states that the Erie Company has recently introduced in Texas a new class of service that is known as the " one way five party service." That is, one may have a telephone in his residence from which he can communicate with all the subscribers connected with his exchange at the rate of $12 per annum, but no one is allowed to call this subscriber and his name is not listed on the books. This same class of service is furnished for business purposes at $15 per annum. Other improvements in the service have been made recently, and President Glidden, who has just completed a tour of inspection on the Pacific Coast and in the Southwest, has arranged for a further material betterment of the system in various directions.

A dispatch from Embreville, Tenn., to the Knoxville *Journal* states that the directors of the Nolachucky Telephone & Electric Company recently declared a dividend of five per cent., payable December 1. This company started three years ago with a capital of $2,500 and a line fifteen miles long. It now has eighty miles of main line. Both towns of Washington county, Jonesboro and Johnson City, are thoroughly gridironed with its wires, and all the progressive men in the county are on the list of subscribers. The company has recently completed a metallic circuit to the Greene county line, which will enable it to give all subscribers through connection to Knoxville via the Greeneville, Morristown and People's telephone lines.

The Iowa Telephone Company purchased a switchboard which had been on exhibition at the Trans-Mississippi Exposition at Omaha and will install it at the Sioux City, Ia., exchange. The cost of the board was $20,000. It is known as a relay multiple board, common battery system, with electric lamp signal, and by means of the multiple feature one operator receives a call and completes the connection without having to transfer it to a second operator, thus avoiding mistakes and misconnections.

The Electrical Committee of Councils at Philadelphia on the 18th inst. took up for consideration an ordinance amending the ordinance granting privileges to the Standard Telephone & Telegraph Company. After a brief discussion, developing some opposition to the amended clauses, the matter was laid over for future consideration. Mr. Wetter, one of the firm that built the conduit for the company, who was present, said that 108 lineal miles of conduit had been laid; that the company had a well equipped factory in the city for the construction of telephonic apparatus and that the enterprise was backed by Philadelphia capital.

A Paris dispatch to the N. Y. *Morning Telegraph* states that the French Government has solved the much vexed telephone problem and will at once introduce in Paris and all the larger cities of the country a new system of telephone service. The plan provides for the erection of a large central station and a number of substations in different parts of the city. Waiting rooms will be provided for the accommodation of the senders and receivers of messages. The latter will be delivered from substations or from the central station at a cost of five cents. It is believed that under the new system the public will be better accommodated than ever before.

E. C. Spalding of Atlanta has been appointed by Judge Emory Speer of the U. S. Court temporary receiver of the Augusta Telephone & Electric Company, in the suit of Thomas & Post of New York. The company is operating the largest telephone plant in Augusta and uses the Strowger system. The Atlanta *Constitution* says that Mr. Spalding can command all the money needed to put the Augusta company on a sound basis and carry out plans for the extension of the service.

A final settlement has been effected between the U. S. Post Office Department and the Western Union Telegraph Company. The amount found due that company on account of the rates fixed by Postmaster General Wanamaker and the rates claimed by the company aggregated $260,000, which has been paid.

All negotiations have been closed between the Oregon Telephone Company and the Santiam Telephone Company for the purchase of the latter's line which connects Salem with Turner, Aumsville, Sublimity and Stayton, Ore. The former company is now pushing forward at a rapid rate, and expects to have a 'phone in every city in Oregon before many months pass.

The telephone line from Tishomingo has been completed to Silo in the Indian Territory. Telephone connection is now complete between Tishomingo, Silo, Oakland, Emmet, Ardmore and other small places in the Chickasaw nation as well as with Durant and Denison, Texas.

A few nights ago an electric light wire at Jackson, Tenn., fell across the telegraph wires of the Nashville, Chattanooga & St. Louis road, burning out the switchboards and setting fire to the stations seventy miles up the line and sixty miles down the line.

The work of constructing a telephone line on the west shore of Lake Champlain, from Whitehall to Plattsburg, has been completed. The line also extends to Upper Jay, Ausable Forks, Keeseville, Elizabethtown, Keene and Westport.

Duluth will soon have telephonic connections with Cloquet and Carlton. The Duluth Telephone Company has obtained the privilege of running its line through the latter place. The company has a large force of men at work and it is expected that the line will be completed in a few weeks.

The new telephone line between Opelika, Ala., and Lafayette has been completed, and Opelika is now the center of a network of wires extending in every direction except to Birmingham.

W. F. Vandiver, F. M. Billing and others have been granted a franchise for the establishment and maintenance of a telephone system in Montgomery, Ala.

The Carolina Mutual Telephone Company's plant at Charleston, S. C., has been purchased by the Gordon Telephone Company.

The Board of Education of Colorado Springs, Col., are considering the question of putting in telephones in the school buildings.

New Companies Incorporated.

The Blissfield Telephone Company, Blissfield, Mich. Capital stock, $3,000.

The Inter State Telephone Company, Cleveland, O.—to construct and operate a telephone line from Cleveland to Cincinnati.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Nov 21:						
Albany Ry. Co	100	2,000,000	$1,750,000	1½ % Q., Aug. '98.	151	158
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug, 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Nov 21:						
Allentown & Lehigh Val. Trac. Co.	..	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Nov 21:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Nov 21:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98.	73	..
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	26¾	27
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec, 1897.	...	..
Boston, Mass.—Nov 21:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97	13¼	13¾
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	10	12
North Shore Traction Co.......pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	76	79
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	83	84½
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	1 0	1 0½
Boston Elevated R. R	100	10,000,000		2¼ % Aug. 98,	76	77
Brooklyn N. Y.—Nov 21:						
Brooklyn City & Newtown Ry	100	2,000,000	1,928,400	2 % Feb. 1, 1898.	215	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	6:½	68¾
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	286	240
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	230	..
Kings County Elevated	....	4,750,000	4,750,000	....	2¾	4
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad.......pfd.	......	6,000,000	6,000,000	....	70	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Nov 21:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	62	66
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	77	78½
Columbus O.—Nov 21:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Aug., '98	56	57
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Nov 21:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '98	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Nov 21:						
Chicago City Ry. Co	100	12,000,000	12,000,000	8 % Q.	290	299
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	10	11½
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Oct., 98.	..	230
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	18,189,000	1½ % Q., Oct. 98	96¼	99
jChicago West Div. Ry.......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	85
Cincinnati, Ohio.—Nov 21:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	29¾	80
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118⅛	118¼
Mt. Adams & Eden Park Inc. Ry	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Nov 21:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	39	41
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	70	74
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98	78½	79½
Detroit, Mich.—Nov 21:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	...	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Nov 21:						
City Railway Co..............com	100	1,500,000	1,470,600	1¼ % Q., Jan 1,'98.	105	..
City Railway Co.............pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	156
People's Street Railway		1,100,000	....	....	102	103

*Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Nov 21:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	–
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	–
Holyoke Mass.—Nov 21:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	185	200
Hoboken, N. J.—Nov 21:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	109	–
Indianapolis, Ind—Nov 21:						
**Citizens' Passenger Ry	....	5,000,000	5,000,000	....	24	25
Lancaster, Pa.—Nov 21:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	–
Lancaster & Col. Electric Ry	...	....	87,500	....	..	–
West End Street Railway	...	....	....	....	..	–
Louisville, Ky.—Nov 21:						
Louisville Ry.................com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	35	40
Louisville Ry.................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	101	103
Minneapolis, Minn.—Nov 21:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	27	29
Twin City Rapid Transit....7 % pfd.	...	8,000,000	1,714,200	1¾ %. Jan., '98.	101	106
Montreal, Canada.—Nov 21:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	273	279½
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	105	105½
Memphis, Tenn.—Nov 21:						
Memphis Street Railway Co	100	500,000	500,000	....	15	–
New Haven, Conn.—Nov 21:						
Fair Haven & Westville RR	25	1,500,000	900,000	4 % S., Sept. '97.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000	....	..	–
Winchester Avenue RR	25	1,000,000	600,000	....	40	..
New Orleans, La.—Nov 21:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	151	200
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	1½	2½
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	8	11
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	16¼	32
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23¼	25
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	51⅞	52¼
New York—Nov 21:						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	245	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98.	180	198
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98.	175	175¾
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	32	37
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	2:8	227
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	180	185
hEighth Avenue RR	100	1,000,000	1,000,000	....	360	400
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	370
jNinth Avenue RR..........guar.	100	800,000	800,000	....	160	170
kSixth Avenue RR..........guar	100	2,000,000	2,000,000	....	200	206
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	350	370
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	178	180
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. 18.	156	160
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	70	72
*Union (Huckleberry) Ry	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Nov 21:						
Consolidated Traction Co. of N. J	100	15,000,000	15,000,000	....	51¼	52
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Nov 21:						
Allegheny Traction Co	50	500,000	500,000	....	49	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '96.	20½	20⅝
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	55¼	55½
pCentral Traction Co	50	1,500,000	‖900,000	....	..	...
qCitizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
rDuquesne Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3 %, Aug., '95.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,100,000	2½ %, Jan., '98.	25½	26
Pgh., Allegheny & Man. Trac. Co	50	8,000,000	‖2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry	25	8,000,000	8,000,000	½ %, Jan., '96.	..	25½
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	300,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Nov 21						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass—Nov 21:						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Nov 21.						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Nov 21:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Nov 21:						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	68	70
Philadelphia.—Nov 21:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14⅛	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98.	67	..
*a*Fairmount Pk. & Had. Pass. Ry.	50	800,000	300,000	3 % Feb. 1, '98.	66	..
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450	....	2¾	27⅞
*c*Electric Traction Co	50	....	8,297,920	....		...
*d*Citizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	320	..
*e*Frankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	400	..
*f*Lehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
*f*Lombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
*d*Second & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	265	...
*e*People's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
*g*Germantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	184½	136
*g*Green & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	185	..
*h*People's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
*h*People's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
*i*Philadelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh., Oct. 98.	93⅛	93¾
*j*Catherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
*i*Continental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
*j*Philadelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	170	180
*j*Philadelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90	..
*j*Ridge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	285	300
*j*Philadelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
*j*17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
*j*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	2/0	..
*j*Union Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
*j*West Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	250
Rochester, N. Y.—Nov 21:						
Rochester Railway Co	100	5,000,000	5,000,000	....	18	15
Reading, Pa.—Nov 21:						
*j*Reading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
*k*City Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
*l*East Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Nov 21:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct., '98.	147	149
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	..	----
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR.	100	2,000,000	1,500,000	4 %, Oct., '98.	90	110
St. Louis RR.	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR.	50	2,400,000	2,300,000	1½ % Oct., '98.	170	175
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry..........com.	50	500,000	500,000	....	54	60
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	114	116
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	52	53
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Nov.						
California St. Cable RR.	100	1,000,000	600,000	50c. monthly.	108	109
Geary Street Park & Ocean RR.	100	1,000,000	875,000	$2.50 share, '96.	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53¾	54
Presidio & Ferries RR.	100	1,000,000	550,000	....	8½	..
Scranton, Pa—Nov 21:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
m Scranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
m Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Nov 21:						
Springfield Consolidated Ry	100	750,000	750,000	....	----	..
Springfield O.—Nov 21:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	..
Springfield, Mass.—Nov 21:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	200	205
Toronto Canada.—Nov 21:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	105	105½
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	278	279½
Washington, D. C.—Nov 21:						
Belt Ry. Co	50	500,000	500,000		..	..
Capital Traction Co	100	12,000,000	12,000,000	65c. per sh, Oct. 97.	79¼	79½
Columbia Ry. Co	50	400,000	400,000	6 % A.	65	70
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	17	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	..	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	128½	130
Worcester, Mass.—Nov 21:						
*Worcester Traction Co......com.	100	8,000,000	8,000,000		12	14
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	98	100
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Nov 21:						
Wilkesbarre & Wyoming Val. Trac	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation. fElectric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
ij Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a. in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Nov 21:						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., Oct., '98.	281	283
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '98.	75¼	75½
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	138	..
New York.—Nov 21:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	95	97
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	107	109
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	180	...
Franklin Teleg. Co....2½ % guar.	100	1,000,000		1¼ % S.	40	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	75¼	75½
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	110	..
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	109	..
Mexican Telephone Co	100	2,000,000				80
*New York & New Jersey Tel. Co	100	5,000,000	3,728,000	1½ % Q., July, '98.	145	150
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000		2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	92	..
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., July, '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	93⅝	93¾
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Nov 21:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	178	174
Chesapeake & Potomac Telep. Co	100	......	......	....	51	
Chicago Telephone Co	100	......	......	....	235	240
Central Dist Prtg & Telg.Co.(Pgh.)	100	750,000	750,000	....	132½	134
Empire & Bay States Telegraph Co.	...	......	......	....	74	76
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	75	80
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	112	118
Providence (R. I.) Teleph. Co	50	....	......	....	89½	..
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Nov 21:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec Series A.	25	......	......	....	...	..
†General Electric Co. [old] com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new] "	100	18,276,000	18,276,000	......	82	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2¾	8¼
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	86⅛	86¾
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., Oct., '98.	57½	59
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Nov 21:						
Edison Elec. Ill'g Co., New York	100	9,188,000	7,988,000	....	149	150
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '98.	..	..
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	28	30
†General Electric Co. [old] ....com.	100	40,000,000	30,460,000	2 % Q., Aug, 1898.	..	...
General Electric Co. [new] .... "	100	18,276,000	18,276,000	......	82	82½
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.—Nov 21:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	165	175
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Nov 21:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	50	50½
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	59½	60
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co	10	6,500,000	550,000	$82500 dis. Jan.11'97	18¾	14
Southern Elec. Light & Power Co	10	187,500	187,500	....	16	..
Miscellaneous.—Nov 21:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	40	..
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	13
Eddy Electric Mfg. Co	25	......	......	....	---	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	125	..
Hartford (Conn.) Lt. & Power Co	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	177	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	84	..
Rhode Island Elec. Protec. Co	100	......	......	....	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	......	2% Q	158¾	159¾
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	137⅞	187⅞
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	..	100	..

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200. of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Nov 21:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$3 per sh. Feb.1, '98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	92	100
New York.—Nov 21:						
Consolidated Electric Storage Co	...	......	....	....	9½	16
Edison European	..	......	....	....	..	...
Safety Car Heating & Lighting Co	100	......	....	......	102½	104
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	36	40
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	99	101
Philadelphia, Pa.—Nov 21:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	--
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	..	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	...	10
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	51	52
Welsbach Light Co	5	525,100	......	....	83	83¼
Welsbach Light Co., Canada.	5	500,000	......	....	..	2¼
Pittsburg, Pa.—Nov 21:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	117	119
Miscellaneous.—Nov 21:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	..	15
*Barney & Smith Car Co.......pfd.	100	......	2,500,000	2 %	60	65
Billings & Spencer Co	25	......	....	....	30	36
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	35	38
Johns-Pratt Co	100	......	....	....	90	100
*Pratt & Whitney Co..........com.	100	......	....	....	4½	8
*Pratt & Whitney Co...........pfd	100	......	....	....	45	50
Stillwell-Bierce Co...........com.	..	......	....	....	..	...
Stillwell-Bierce Co............pfd.	..	......	------	2 % Sept. 1, '97.	95	98
Shultz Belting Co	100	500,000	------	....	82	87
St. Charles Car Co	--	------	------	----	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Nov 21, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co .....Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*113	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*112	114
‡Watervleit Turnpike & RR.1st mtg. 6s	850,000	850,000	1919	M. & N.	*120	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*116	....
Troy City Railway Co...................1st 5s	....	....	......	......	*106½	......

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Nov 21, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115⅛	117
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115⅛	116
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103	104
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	116	117
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	102	103
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	117	119
City & Suburban Ry......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	115	115¾
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113⅛
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	120

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	103	105
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105¼
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation - Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	..
†Charleston City Ry...........1st mtg. 6s.	850,000	....	....	J. & J.	....	

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102	102¼
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	105½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	62½	......
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¼	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	101½	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	106½	107
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	107¼	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	101	......
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	95	......
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Nov 21, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	105¾	106
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	108	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	......	118½
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	....	135

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	105½	106
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	105¾	106
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	105	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102½	103½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	98½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	......	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	108	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	107	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 5	100,000	94,00[illegible]	1909	M. & S.	103	......

*With interest. †Unlisted.

New Orleans La.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR.............1st mtg. 6s.	......	50,000	1899	M. & N.	101	83⅛
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83	...
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	104⅛
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	104	....
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	......	....
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	105	......

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	110	111
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122⅝	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	116	119
Broadway Surface............2d mtg. 5s.	1,000,000	1,000,000	1905	......	106	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	117
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	93
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	110	112
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	104½	105
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	106	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	103	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111	113
Central Crosstown RR.........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	120
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	116	116½
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	102
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	98	100
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	122½	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	117	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	115¾	116¼
Second Avenue Ry...............Deb. 5s.	300,000	300,000	1909	J. & J.	109	110
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co..........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	125	......
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	112½	115
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112½

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Nov 21, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry...................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry...................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	105½	105¾
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s.	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	....
West End Passenger Ry.........1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Nov 21 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	......	......
Central Traction Co................1st mtg. 5s.	875,000	875,000	1930	J. & J	......	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	115	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	......	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	....
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	......
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	......	....
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	......
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	106	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	111	......
Second Ave. Traction Co......................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	108½	109½

St. Louis.

Date of Quotation—Nov 21, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	1,000,000	1,000,000	1913	J. & J.	111½	112½

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Nov 21, 1898.						
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co..........1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co.	1,000,000	700,000	1916	M. & S.	107	108
†Mound City RR. Co..........1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	103
People's RR. Co..........1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‡People's RR. Co..........2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co..........Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co..........1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry..........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry..........Income 5s.	300,000	300,000	......	....	60	65
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
†Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	112	113
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.......Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	114½	115½
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
|$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Nov, 1898.						
California St. Cable RR....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	115½	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	114½	....
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	128½	129
†Metropolitan Ry. Co..........1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co..........1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126	......
†Park & Cliff House RR..........1st mtg. 6s.	350,000	350,000	1912	J. & J.	106½	108½
†Park & Ocean RR..........1st mtg. 6s.	250,000	250,000	1914	J. & J.	112	......
†Powell St. Ry..........1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	123
Sutter St. Ry. Co..........1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Nov 21, 1898.						
Belt Ry. Co..........Cons mtg 5s.	500,000	450,000	1920	J. & J.	51	....
Columbia Ry.......... mtg. 6s.	500,000	500,000	1914	A. & O.	118	125
Eckington & Soldiers' Home.. mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	128	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Nov 21, 1898.						
Bridgeport Traction Co.........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	101	106
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	112⅛	114
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	110¾	111
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	103	105
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	109¼	109¾
|Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	102	102½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	116	117
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	96	100
††No. Hudson Co. Ry. (N. J.). Cons. mtg. 5s	3,000,000	2,878,000	1928	J. & J.	104	......
No. Hudson Co. Ry. (N. J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry..........1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	99	101
St. Paul City Ry..........Cons. g. 5s.	5,500,000	4,298,000	1937	......	......	......
St. Paul City Ry..........Deb. g. 6s.	1,000,000	1,000,000	1900	......	......	....
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
|$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.						
Date of Quotation—Nov 21, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	101⅛	....
Pittsburg, Pa						
Date of Quotation—Nov 21, 1898						
Allegheny County Light Co..........6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light..........4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co. Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Nov 21, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	110⅛	115
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	117	120
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	110	115
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	....	......
Edison Illg. Co. (St. Louis)..............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.						
Date of Quotation—Nov 21, 1898.						
American Bell Telephone..........7s.			1898	F. & A.	102	....
Northwestern Telegraph Co..........7s.	....	......	......	......	....	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co....5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.						
Date of Quotation—Nov 21, 1898.						
American Electric Heating..........5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co..........	....	....	......	......	......	25
Barney & Smith Car Co..........†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co..........6s.	....	....	1904	M. & S.	....	....
Washington Pump Co..........	75,000	......	......	......	......	....

*Unlisted †Nominal

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12⅝@12¾c.; Lake, 13c.; casting, 12⅝@12¾c.

The Third Avenue Railroad Company, New York, has declared a quarterly dividend of $1.75, payable November 30. Books reopen December 1.

The Stilwell-Bierce & Smith-Vaile Company of Dayton, O., has declared a dividend of 2 per cent. on its preferred stock, payable December 1. Books reopen December 1.

At a special meeting of the stockholders of the Bossert Electric Construction Company, Utica, N. Y., on the 16th inst., it was decided to increase the capital stock from $16,000 to $75,000, to consist of 750 shares of $100 each.

Judge Grosscup of the U. S. Circuit Court at Chicago has declared null and void the ordinance giving a street franchise to the General Electric Railway Company on the ground that proper consents from property owners were never obtained.

In the U. S. Circuit Court at Chicago last week Judge Showalter entered a decree ordering the sale of the Metropolitan West Side Elevated Railroad, the upset price to be $6,000,000. It is expected that the sale will take place early in January next.

It is stated in a dispatch that the Milwaukee Street Railway Company, upon a guarantee that competition in the street railway business will be shut out, has agreed to pay, in addition to its taxes, an annual sum which will amount to $1,000,000 in ten years.

At the annual meeting of the Third Avenue Railroad Company, New York, on Wednesday last, Samuel Riker was chosen a director to succeed R. W. Tailer, resigned, and John Beaver, treasurer, was appointed secretary temporarily in place of Alfred Lazarus, whose death occurred on the Tuesday preceding the meeting.

The Newport News and Old Point Railway & Electric Company of Newport News, Va., on the 16th inst. filed in the Elizabeth City County Court a mortgage deed, securing $900,000 of bonds issued by the railway company. The bonds were sold to Alexander Brown of Baltimore and the Maryland Trust Company.

The directors of the Newport & Fall River (Mass.) Street Railway Company have declared a semi-annual dividend of 3 per cent., payable January 1 to stock of record December 15. This is the first dividend declared by the company. The road has been in operation since June 19 and up to November 1 earned net $20,897.

Suit has been entered at Pittsburg, Pa., by the Pittsburg & Birmingham Traction Company against H. Sellers McKee, Murray A. Verner and others, who, as charged in the bill, "did by various contrivances, schemes and acts in 1891, 1892, 1893 and 1894 cheat and defraud the Traction Company out of a sum exceeding $1,000,000."

The reorganization committee of the Staten Island, N. Y., Rapid Transit first mortgage 6 per cent. bonds, due January 1, 1913, J. W. Davis, chairman, announces that a large proportion of the bonds have already been deposited with the Guaranty Trust Company of New York, and that the time for receiving additional deposits has been limited to December 5.

The amalgamation of the Kings County Electric Light & Power Company and the Brooklyn Edison Electric Illuminating Company went into effect on the 14th. The Edison Company will continue its organization as heretofore, but the electric light business will now be directed by the managers of the Kings County Company, which represents a union of the Citizens, Municipal, Edison and Kings County companies.

A report comes from St. Louis that consolidation of five of the largest street railway corporations in that city, of which the Lindell Railway and the Missouri Railroad are the principal lines involved, is now under consideration and will be arranged by January 1. The present capital stock of the five roads is $6,400,000 and they are bonded for $3,700,000. The consolidated lines will be incorporated for $10,000,000.

The negotiations looking to the consolidation of the City Passenger Railway Company and the Consolidated Street Railway Company, of Baltimore, will, it is thought, eventually culminate in the purchase of the former by the latter. Should this come to pass about $12,000,000 would probably be involved in the deal and $1,000,000 or more would be expended in immediate improvements, including the change of some cable lines to electricity.

The annual returns of the Connecticut street railroad companies for the past year, now in the hands of the State officials, show that the most prosperous roads, judging by the dividends paid, are the Hartford Street, 3½ per cent.; Danbury & Bethel, 4 per cent.; Fair Haven & Westville, 6 per cent.; New London Street, 5 per cent.; Norwalk Street, 4½ per cent.; Waterbury Traction, 3 per cent., and the Winchester Avenue, which paid in dividends last year a sum equal to over 8 per cent. on its stock.

A press dispatch states that a consolidation of the electric light companies of Baltimore has been virtually completed. The plan is to merge the Brush Electric Company, the Edison Illuminating Company and the Northern Electric Company into a new company, which would have a capital stock of $5,000,000 and bonds of $4,000,000. The Brush Company is controlled by the Westinghouse Company of Pittsburg, and the Edison Company is owned by the General Electric Company. The Northern Electric Company is composed of Baltimore capitalists.

Under the decision of Judge Coxe obtained last month against the General Electric Company, sustaining the patent of L. B. Marks on an arc lamp infringed by the General Electric Company, the Marks Enclosed Arc Light Company has compelled the removal of a number of General Electric lamps installed in New York. Notice has also been served on B. Altman & Co., the largest users of General Electric lamps in New York, to remove the lamps. The General Electric Company is alleged to have sold 40,000 of these lamps, all of which infringe the Marks patent.

The Boston "Advertiser" says: "The result of the over-bonding of many Connecticut electric roads has become apparent in their reports. Out of 27 only 10 have been able to pay dividends so far this year. These 27 roads have during the past nine months issued approximately $11,311,800 of bonds as compared with $9,092,800 last year, and yet their gross earnings show but a slight increase, while the net show an actual decrease. The time is not so far distant when the first flush of the boom in trolley roads will have worn off. Thus it is likely that a general reorganization throughout the country, similar to that in steam roads will begin. Naturally there are many electric lines to which these strictures do not apply, but the majority are certainly open to them."

Henry Clews in a letter published in the New York "World" speaks optimistically of the business outlook, and, referring to the stimulating effect on trade of the approaching Paris Exposition, says: "The most marvellous ingenuity we shall see there displayed will undoubtedly be in the various uses of electricity. This wonderful agent is coming more and more completely under human control every day and new uses are constantly developed. It is bound to play a very important part in the future and will almost revolutionize many industries, and instead of the present concentration into huge manufacturing establishments, the tendency will be toward distribution. We shall soon see it installed in the humble apartment of the lowliest workingman, and many tasks may then be finished amid the peaceful surroundings of his home, and who can gainsay the great moral benefit ensuing."

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CONTENTS.

EDITORIAL NOTES.

The Recent Snow Storm and the Underground Trolley.

The unusually heavy fall of snow which visited this region on the 26th and 27th inst. succeeded in throwing out of service almost without exception every conduit electric railway system operating in New York City. Trouble was experienced on all the electric lines of the Metropolitan Street Railway Company which prevented the running of cars for periods ranging from a few hours to twenty-four. For some reason the line apparently the least affected was the Madison avenue line, whereas the Lenox avenue line had to stop operating on the evening of the 26th and traffic was not resumed until the following evening. The other electrically operated lines, namely those along Second, Sixth and Amsterdam avenues, fared about as badly as that along Lenox avenue. The storm, leaving a fall of 12 inches of snow on the level in the city, was probably without exception the most trying that has visited this neighborhood since the adoption of conduit electric traction by the Metropolitan Street Railway Company, and what undoubtedly added to the difficulty in keeping the lines in operation was the fact that so severe a snow storm was scarcely looked for so early in the season and consequently caught the street railway companies unawares.

The stalling of the several underground trolley systems is explained by President Vreeland of the Metropolitan Company as follows :

"The snow of Saturday last was of a particularly wet kind, and melted quickly when it touched the rails of the street car lines. Ice then formed. In the case of the electric lines the presence of ice on the tracks prevented the wheels of the cars coming in contact with the iron rails, thus preventing the establishment of a circuit. Having no electrical power the cars, as a matter of course, could not move."

For that matter, however, this trouble was not confined solely to the conduit systems, but was also experienced in New Jersey, Long Island, and in fact in all the surrounding country, on the overhead trolley systems as well. The stalling of all the conduit systems owing to ice on the rails, which is a very serious matter in a city such as New York, brings up the question as to why the wheels and rails are relied on at all for completing the circuit. As the Metropolitan Street Railway Company is obliged to spend between $60,000 and $80,000 a mile when putting in its conduit systems it would seem as though for a few thousand more provision could be made for a complete metallic circuit without regard to the rails, and thus the chance of all the lines becoming inoperative in a snow storm would be to a great extent eliminated. In view of the fact that a storm such as the last means the loss of thousands of dollars to the company in fares, it would certainly seem as though it would be to its interest to provide a metallic circuit independent of the rails, to say nothing of the convenience of the public.

* * *

An Aerial Electric Railway.

So-called aerial railways, or those in which the cars are suspended from an overhead structure of some description, have been thought of and suggested from time to time as a means of overcoming some seemingly insurmountable difficulty, but none has as yet, at least to our knowledge, ever been constructed and put in actual operation. About a year ago a company was organized and plans drawn for an aerial railway over what is known as the Dyea trail, an extremely difficult portion of the route leading to the Klondike. In this case a heavy cable suspended on steel columns thirteen feet in height and 100 feet apart was to have served as the track, from which specially designed cars were to have been hung by means of steel bars. A second cable attached to the car itself was to have drawn it along by being wound upon a stationary motor located at an intermediate station on the line. The whole arrangement was apparently very crude, but this could probably be accounted for in the inaccessibility of the locality and in the desire on the part of the promoters to furnish some means of transportation which could be rapidly constructed. Recently, however, an electrically operated aerial railway has been suggested in Germany on which the work of construction has actually begun. Some method of transportation was found necessary connecting Elberfeld and Barmen, two cities situated about eight miles apart. Owing to local circumstances and to the topography of the country, apparently the only available route was over the bed of the river Wupper, but strenuous objections being raised against any obstruction of the river to navigation, the building of an aerial railway was determined upon. With this idea in view, inclined structural steel girders are being placed in either bank about sixty feet apart and will be held in position by means of longitudinal beams and trusses to which the rails will be attached. The structure will necessarily be quite high, as a number of bridges have to be passed over and a headway of sixteen feet is required between the bottom of the conveyance and all bridges. The cars will be hung from two rails, the axles of the wheels being supported on movable trunnions. Access to the cars, which will have a seating capacity of fifty,

will be had at given points by means of iron stairways leading up to platforms. The motive power will be electricity, which it is expected will propel the cars at a rate of speed of twenty-five miles an hour. There will be a double track along the whole length of the line, and every possible precaution will be taken in providing automatic devices with a view to eliminating all chance of danger should a car through any mishap become disabled. The work of construction is now progressing so rapidly that it is thought that by spring this novel railway will be in operation. Just why it was deemed advisable to operate this line as an aerial one instead of as an elevated road is hard to see for a structure such as had to be built to support the weight of a moving car hanging from it, especially when any swaying due to the action of a heavy wind is taken into account, would surely have been sufficiently strong and rigid to support the weight of a car moving along its top. Furthermore, had an elevated road been projected, built on the same principle as the aerial one, the cost would have been much less, as the structure would not need to be so high. The fact that an untried aerial railway was decided on, however, can probably be accounted for in the fact that as a rule foreigners do not take kindly to elevated roads such as we have in this country. In any case the opening of this aerial railway will be watched with interest and will undoubtedly be as unique in its way as the balloon railway in the Austrian Alps leading to the summit of the Hochstauffen Mountain at Bad-Reichenhall.

* * *

Excellent Showing of the Electrically Operated Machinery on the Brooklyn.

Some time ago we called attention to the advantages to be derived by equipping the new battleships of the Navy with electricity for operating not only the ammunition hoists and turrets, but all the other auxiliary machinery, such as winches, steering-gear, etc., as well. We now understand that this question of using electricity as the principal motive power in lieu of steam on the vessels of the Alabama class as well as on the Maine, Missouri and Ohio, for which contracts have but recently been let, is receiving careful consideration at the hands of the Board of Construction. This condition of affairs has been to a great extent brought about by the excellent detailed reports received by the Navy Department from the officers in charge of the Brooklyn, who were in a position to speak authoritatively of the comparative merits of the two forms of motive power. The Brooklyn is unquestionably the most thoroughly electrically equipped vessel now in commission in the United States Navy. Besides the ordinary electrical installations to be found on every modern war vessel at the present time, four 5-inch ammunition hoists, two 6-pounder ammunition hoists, eight 8-inch ammunition hoists and the forward and starboard turrets are all operated by electricity and were so operated during the naval engagements in Cuba. Lieut. W. R. Rush, of the Brooklyn, in an official report to the Navy Department as to the merits of electricity, says:

"In obedience to your orders requiring a report upon the relative efficiency of steam and electrically-controlled turrets, viewed in the light of the experience of July 3d in the naval fight with the Spanish fleet, I respectfully submit as follows:

"A board, of which I was senior member, appointed by your order of September 29, 1897, upon the same subject reported then: 'In suggesting modification in form or installation of turret guns or fittings, the board begs to reiterate its unqualified approval of electricity as the power for training turrets. To anyone who has trained turret guns upon a target by electricity, and who has afterward attempted to do it by any other means, the contrast is too striking ever to be forgotten. The electric motor and controller give perfect control and fineness of train to an ideal degree.'

"Now, after experience in handling turrets under fire, in a running fight of four hours, I fully endorse the report of the board given above. I would like to add in favor of electric turrets that the temperature of the closed handling room of the steam turrets was terrible in comparison. There was also the danger of death to everybody in the handling room from shell cutting a steam lead."

Lieutenant James G. Doyle of the same ship also submitted a lengthy report in which among other things he states:

"I have been closely associated with the turrets of this ship, both steam and electric, before and since the commissioning of the ship on December 1st, 1896, and have had the best of opportunities of observing their relative merits. I had charge of one of each kind during the battle with the Spanish fleet off Santiago on July 3d, the port waist (steam) and the starboard waist turret (electric). The facility with which the starboard turret guns (electric) were laid on the enemy's ships leaves no doubt in my mind that electricity is immeasurably superior to steam as the turning power for turrets, and I also believe this ship would be more efficient than she is now if electricity was adopted for the port and after turrets."

The above reports would seem to prove conclusively that electricity even under the most trying conditions is for many reasons better adapted for operating the turrets in a warship than is steam, and the fact that arrangements have about been made for operating the turrets of the Alabama, Illinois and Wisconsin by this form of motive power would seem an acknowledgment of the superiority of electricity over either steam or compressed air, but still leaves the question open as to whether all the auxiliaries should be operated likewise by the electric current. This important point, however, is covered by Admiral Sohley in his report to the Navy Department, in which the following statements appear:

"I would respectfully report that I am of opinion that the use of electricity as a motive power for all turrets, ammunition hoists, and all auxiliary machines on board ship not in the engine rooms is desirable and would increase efficiency.

"The use of steam for operating turrets makes necessary great lengths of piping and produces almost insupportable heat in the handling rooms; with electricity this is avoided and greater celerity is accomplished.

"In the battle of July 3d, the turrets controlled by electricity did better and quicker work and were not so hot as those functioned by steam.

"I would, therefore, heartily recommend electricity for these purposes."

The fact that no trouble of any sort arose through the use of electricity on the Brooklyn certainly speaks well for the electrically operated machinery, and proves beyond a doubt that the time has arrived when apparatus of this nature can be installed with confidence for almost every purpose on shipboard, and furthermore it would seem as though the excellent results obtained warrant its extensive use on the new ships of the United States Navy, to say nothing of the fact that for a Russian battleship now under construction in this country the use of electricity is contemplated for the manipulation of practically all the auxiliaries.

CABLE dispatches inform us that Spain has yielded all the United States Commissioners contended for, relinquishes Cuba and cedes Porto Rico, Guam and the Philippine Islands. This should stimulate the discoverers of wireless telegraphy to renewed zeal in the effort to perfect their inventions. We need some means of bringing our widespread possessions closer together, and if we can hold them without wires the whole country will rejoice and electricity be glorified.

Under the Searchlight.

Notes and Comments on Various Topics.

WHILE a certain manufacturer of acetylene gas generators in this city was showing a prospective customer, an Ohio lawyer, the working of a generator in the company's office the other day an explosion occurred. In lighting the jets of the machine one was forgotten and the gas escaped to the upper part of the room, where, after reaching a certain density, it exploded. The window pane was blown out into the street, and the lawyer in his haste to get out broke two panes of glass in a door with his cane. There was no other damage.

* * *

IN a recent damage suit brought against a local street railway company the defendants in support of their claim produced a trolley car—if not in court, at least as near as it could be gotten there, at the front door. Needless to say they won their case. If this tendency to produce mammoth mechanical evidence keeps on, the court rooms all over the country will have to be enlarged.

* * *

A CHICAGO inventor claims he has devised a new steam turbine which will be the means of propelling a railway train between New York and Chicago in sixteen hours, and may also be arranged to drive steamers at the rate of forty miles an hour. The Windy City is certainly fertile in producing startling inventions, which usually end in wind. Thus is the city well named.

* * *

His Rise.

(From the Cleveland Leader.)

There was a man who started out
  To elevate the human race,
To clear old heresies away
  And make the world a better place.
He delved in ancient, musty tomes,
  He often burned the midnight oil,
And labored that this busy world,
  Might be the better for his toil.

He wrote in verse and otherwise
  The lessons that he had to teach,
But no one bought his books nor would
  The people listen to him preach.
For years he sought to make the world
  A better and a fairer place—
To clear old ignorance away
  And elevate the human race.

At last, half starved and in despair,
  He put his books and pen away,
And lo! that which he strove to do
  He does with simple ease to-day:
He elevates the human race—
  Read on, and I will tell you how—
His rusty pen is idle, but
  He runs an elevator now.

* * *

THE arc lamp maker, says *Lightning*, London, is seldom without a tale of woe. The last I have been told is by an English maker who sent some arcs to North Italy, where they are supposed to know something about electricity. There came back a complaint that the lamps would not work satisfactorily like the German ones. On inquiry it came out that in the capital of Piedmont they are capable of ordering continuous-current lamps and putting them on an alternating-current circuit.

* * *

X-RAY parties, according to the New York *Sun*, are the latest fad in Brooklyn. Brooklynites nearly always amuse themselves seriously. Think of the trolley parties that they have! And those who know say that a trolley party is as devoid of smiles as a page in a newspaper run by women. But the X-ray party promises to oust the trolley party, at least during the winter, and it certainly is far more amusing. Few people think of science as side splitting, but they do say on the other side of the bridge

that the "X-rays are too funny for anything." These X-ray entertainments are given, of course, for charity; Brooklyn always amuses itself for the benefit of somebody or something. Such a thing as enjoyment for enjoyment's own sake is frowned down on from the Heights to the Hill.

Mind Pictures by Telephone.

"Did you ever notice that when an idea becomes fixed in the mind it is very difficult to change it, especially in the case of extremely sensitive and highly nervous persons?" asked a Brooklyn expert on nerves. "Not long ago I had a visit from a man who was afraid he was losing his reason because of a very simple persistence of a certain thought or idea which he could not shake off. The history of the case is one often found in cases of hypochondriasis developed from using the telephone. My patient for about a year's time had occasion to telephone every day to a trade customer in New York—Manhattan if you like.

"The New Yorker had a peculiar high tenor squeak to his voice, and somehow my friend got to picturing him as a little chap with a thin face. This habit grew day after day until the customer took a real shape and form in the mind of my patient, all based of course upon his voice. As he talked over the telephone there always was mentally pictured that little chap with the thin face and squeaky voice. Well, one day my patient called at the office of his New York customer, and as he walked into the place and saw a tall, fat man weighing nearly 300 pounds he could scarcely believe his eyes. When the fat man opened his mouth and talked, my patient says, the squeaky voice with which he was familiar sounded strange and unnatural. He told the owner of the absurd voice, in view of his size, about having pictured him as a little thin person, and there was a good laugh over the odd difference of the reality.

"But the next day when my friend used the telephone and the squeaky voice came to him, he had to struggle to get away from thinking of his fat patron as being little and thin. He talked the matter over with his wife and laughed about it, but soon there came a time when he forgot all about the actual existence of his customer, and the little thin-faced chap was again talking to him over the wire. Then it was that he came to me. He feared, he said, that his mind was giving way, because of the persistence of the odd picture of the thin man. I thought the case was easily disposed of, and told my friend to go to New York every day for a week and visit his fat customer. This he did, but every time he telephoned the squeaky voice would bring up the mental picture formed before he had set eyes on its owner.

"I was in despair and my patient was growing gray from worrying when I hit upon the happy expedient of placing a photograph of the fat man on the telephone, where the eye of the patient could rest upon it as he talked. The result was the disappearance forever of the thin chap. My patient, in looking at the picture of the owner of the squeaky voice, got his mind working upon the same lines that would have been followed had he met the fat man face to face the first time he heard his voice. These cases are common every day. We form queerly opposite pictures of men and women we hear over the telephone and never see, but in the great majority of instances the impression is a momentary one, and it is seldom that the mistake is ever forced upon us in the startling way described by the patient told of.

"The telephone, by the way, has produced very many queer cases of neurasthenia that remain unaccountable excepting on the hypothesis that the new habit brings them into existence. I have had very many patients who had to give up the use of the 'phone altogether where it had been used to a great extent before."—*New York Sun.*

SURFACE CONTACT ELECTRIC RAILWAYS.*

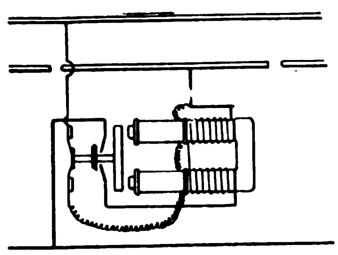
BY EDWARD H. JOHNSON.

In considering the problem of electrically operated surface railways, as in considering other problems, one inventor will from motives of expediency follow the general trend of the commercial evolution of his art, while another will look beyond and seek that solution which shall possess the element of permanency by virtue of being founded on correct theory.

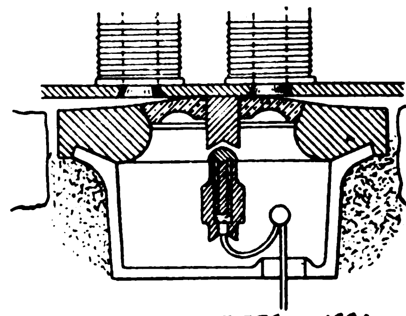
In no branch of modern electrical development has this divergence of inventive tendency been more marked than in that of electrical distribution for tram car service. The quick, cheap and effective overhead trolley afforded the "expediency" inventor a fruitful field. It was a rich harvest but it was a harvest of one season only. That season has passed. The phenomenal success of the electric tram car has in itself forced a "public opinion" in antagonism to the overhead supply system, hence the "expediency" inventor is again requisitioned, and following his nose with the instinct of his class says, "Take the trolley off the poles and string it in a cable slot." The fact that electricity and water are mortal foes and that a cable conduit is nothing more or less than an open street sewer has no weight with him since his client's margin of earnings is sufficiently great to permit not only of enormous expenditure for a construction that will secure drainage but also for paying the considerable cost of the excessive leakage inherent in the system.

It thus comes to pass that in metropolitan streets, where the traffic is of "bonanza" proportions, the problem of complying with a public demand may be and is being met by a brute force solution—a solution neither in consonance with scientific or commercial principles.

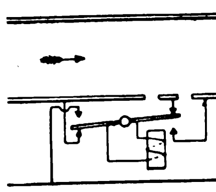
That such a solution of the problem is no solution at all for at least 99 per cent. of the tramways of our



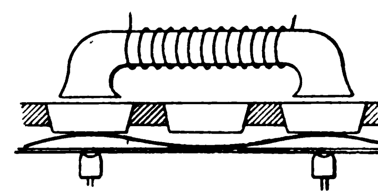
HOPKINSON—1882.



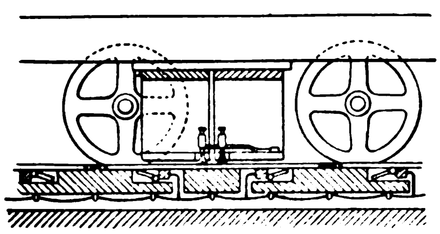
DIATTO—1894



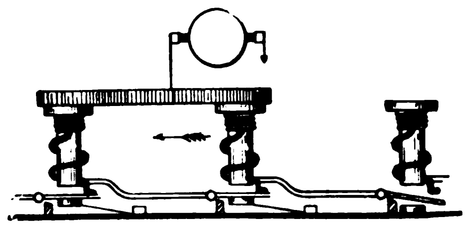
AYRTON-PERRY—1883



LINEFF—1888



POLLAK-BINSWANGER—1886



WYNNE—1887

American cities can easily be demonstrated by a comparison of their possible net earnings and the interest on the great investment demanded by it.

A further development of the art is therefore essential, and the brother inventor must now, perforce, be granted a hearing. Of him is required a solution of the problem which shall possess the element of permanency and which shall yet not demand an investment of prohibitive proportions. Immediately this inventor opens with his plan it is recognized as an old acquaintance, to whom not much attention has hitherto been paid and who has, in the whirl of expediency, been passed by with a gesture of impatience. Present necessity, however, now secures the recognition heretofore denied, and lo! it is discovered that not only is the plan a true solution but that it was as a matter of fact evolved fundamentally from the brain of the late and lamented Dr. Hopkinson 16 years ago, and it is safe to say that had it met with a tithe of the encouragement given to its overhead and open conduit brothers it would have been more speedily perfected, and neither the overhead nor the underground trolley would to day exist upon a single important street in either city or town.

An important factor effective in retarding the development of a sound system has been the unwillingness of the larger street railway syndicates to see any underground system a demonstrated success. Their overhead charter rights generally contain an obligation to substitute such a system on proof of its practicability, hence their determination to damn it in the eyes of the public and municipal authority. Even yet the corporations owning trolley franchises, while suffering their associates to develop the costly open conduit in the great and wealthy metropolis, having no fear of its being forced upon their less prosperous lines in minor cities, assume a position of determined hostility toward the cheaper and superior system, knowing full well that a single demonstration of its practicability in New York would promptly compel its general adoption in Philadelphia, Boston, Chicago and elsewhere.

* Read before the New York Electrical Society, Nov. 16, 1898.

THE PERMANENT SOLUTION.

The surface contact system, as its name implies, delivers the current to the moving car by virtue of contact between a bar or "skate" carried by the car and sectional conducting metals fixed in the surface of the roadway. The mere statement of the general conditions suggests as an essential requisite that the current shall be there for the car only, and not for the horse or other street user. This in turn implies the automatic charging of the surface contact points when needed by the car and their automatic discharge when the car has passed, by means of some force associated with the car itself, and since we are dealing with currents of many horsepower, it follows that the individual factors in this automatic operation must be absolutely reliable. In fact, the devices employed for the discharge of the current at least must be infallible. Nothing less will avail, since there can be no divided responsibility for accidents resulting from the use of such a system. A live section is as innocent looking as a dead one. It gives no notice to the street user and hence he is not charged with the responsibility of avoiding it. Under these circumstances the law would promptly condemn the system and compel its abandonment upon its first offence.

One deterring force of substantial weight which has operated to keep this system in the background is the common impression that these automatic factors could not be so designed as to at all times and under all circumstances possess this property of infallibility. Mr. Lundell and I have, however, held to the contrary, and after more than three years of almost continuous experimental work and practical demonstration are now able to challenge those who hold otherwise to place their finger upon a weakness in the system, which, if accidentally developed, would result in a dangerous electrification of the street.

The history of the origin and evolution of the surface contact idea is too varied and voluminous to be recounted in a brief paper, but I have prepared a few illustrations of the most ambitious efforts that have been made from Dr. Hopkinson down to our own, and will note briefly their salient features.

Dr. Hopkinson, the originator of the idea of surface contact, had only in mind the prevention of heavy leakage from a commercial point of view and not at all a matter of securing safety. Hence, his electrical connections were not designed and could not be considered for a moment as factors of safety. He simply overlooked the point of vital importance.

Ayrton & Perry 1883) simply diversified the electrical connections in many ways, but clearly with only the Hopkinson end in view. Their system was thus not superior to Hopkinson's and therefore no better adapted to secure safety.

Pollak & Binswanger (1886) were among the first to recognize the importance of safe-guarding the street, and they adopted the idea of operating switches in the street by electro-magnetism developed on the moving car. They have had many followers, among whom may be mentioned Wynne, 1887, Lineff, 1888, and Diato, 1894. The principle has, however, been found inadequate because unreliable at high speeds, a fact readily comprehended by those who understand the laws governing magnetism.

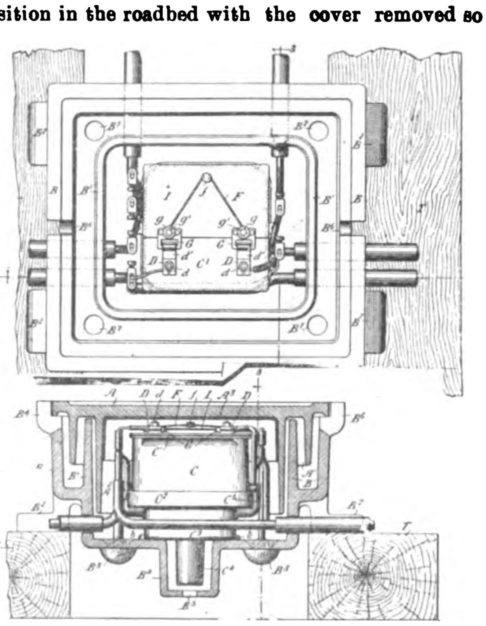
The latest candidate for honors in surface contact development is Prof. Sylvanus P. Thompson, who endeavors to combine the good points of the electro-magnetic switch system with the good elements of the pure "magnetic pick-up" system. The result is, however, not a happy one, as it involves the switch in complication, whereas, as every engineer and mechanic knows, an essential condition of infallibly operative mechanism is that it should be reduced to the last stage of simplicity, viz., a weight falling in free air.

As these multifarious steps in the evolution of the art have been taken, it has become more and more apparent that the positive acting electro-magnetic switch energized directly by an ample electric current, and possessing, as it does, the quintessence of mechanical and electrical strength and simplicity, will alone yield the positive and reliable results demanded in railway work. Moreover, as it has been found that a certain "time allowance" for the operation of the switches is essential for high-speed work, a duty requiring the switch to operate before it is reached by the contact shoe of the car, it is of course apparent that since the electro-magnetic switch is the sole device capable of responding at a distance, it alone is equal to such duty.

Mr. Lundell and I have from the outset recognized these severely exacting conditions, and have accordingly based our work entirely upon the electro-magnetic switch and sought to reduce it to the acme of simplicity and consequent reliability, as well as to evolve a system of circuit connections equal to every requirement of speed, direction, capacity, economy, reliability and safety. These results we not only claim to have achieved but in doing so to have produced a system so inexpensive as to justify its adoption wherever the overhead trolley is now financially successful.

THE SWITCH.

Fig. 1 is a plan view of the switch box in its position in the roadbed with the cover removed so



FIGS. 1 AND 2.

as to show the internal structure thereof (the line 2 2 being parallel with the roadway).

Fig. 2 is a sectional view taken on the line 2 2, Fig. 1.

Fig. 3 is a transverse sectional view taken on the line 3 3, Fig. 1.

Fig. 4 is a vertical sectional view taken through the body of the switch-enclosing box on the line 4 4 of Fig. 5, which latter figure is, in turn, a horizontal sectional view of the same switch-enclosing box taken upon the line 5 5 of Fig. 4.

Referring to the drawings in detail, and first to Figs. 1, 2 and 3, B represents a cast iron protecting box of rectangular form and provided with four legs, B^2 B^2 B^2, adapted to sustain the box in position between two ordinary cross ties, T T. This box is cast in one piece with an upwardly extending inner flange, B^1, running entirely around the interior of the box and adapted to form with the top or interior flange, B^4, a deep-seated groove, which we may call a mud groove.

A represents the cover of the box, which is also of cast iron and is provided with two downwardly extending flanges, A^1, A^2, the flange A^1 being adapted to extend a considerable distance into the mud groove, as will be seen on examination of Fig. 2.

The flange A^2 is somewhat longer than A^1 and extends to a point near the bottom of the box B, forming a sort of a dividing ball for the protection of the fuse block and terminals shown in the figures referred to.

The inner surface of the cover or lid A is lined with insulating material for the purpose of preventing any possibility of the continuance of an arc when the fuse, which is shown in Fig. 1, blows.

The switch enclosing box proper (see Figs. 4 and 5)

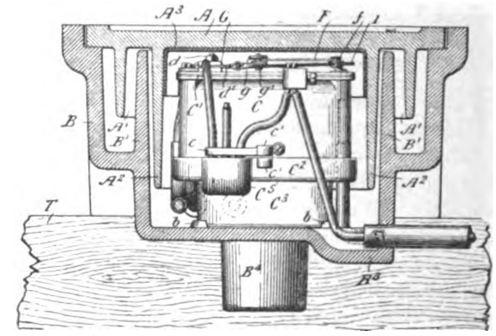
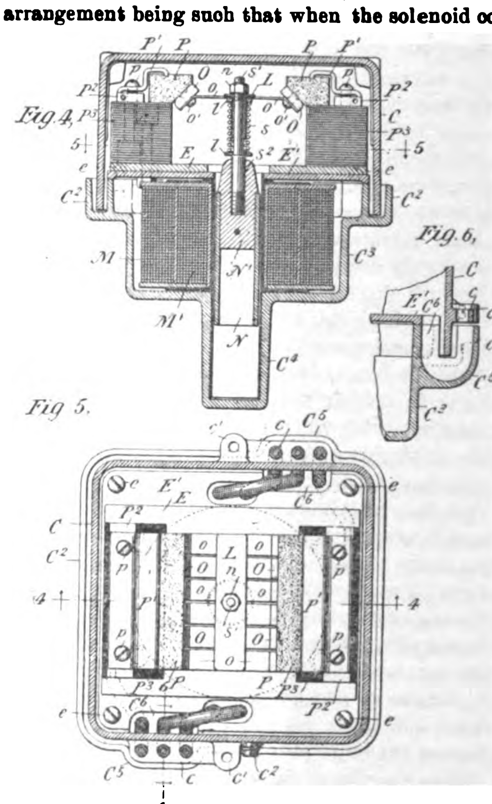


FIG. 3.

is composed of two cup-shaped parts, C and C^3, the lower part, C^3, being provided with an upper grooved extension, C^2, and a lower cylindrical extension, C^4, the arrangement being such that the lower edge of the upper portion, C, of the enclosing box will fit within the grooved portion, C^2. The lower portion, C^3, constitutes not only a part of the enclosing box but is also adapted to act mechanically as a part of the magnetic circuit of the electro-magnetic switch, E^1, being a cast or wrought iron plate with an opening in its center and held by small screws, e e e, to the upper face of the inner part of the grooved portion, C^2.

The lower part, C^3, of the enclosing box constitutes a chamber for the switch operating magnet, which is of solenoid form and is provided with two windings, M and M^1. the circuit connections for which will be described later.

N is a hollow solenoid core of soft iron secured to an insulating standard, N^1, which, in turn, is secured by a rod, S^2, to a series of yielding conducting arms, O O O, having secured to their outer ends a series of good metallic conductors, o o o, the whole arrangement being such that when the solenoid core



is in its lower position the metal contacts, o o, will rest on the upper surface of the insulating plate, E.

P^3 are blocks of insulating material, preferably slate, and P^2 are blocks of conducting material secured to the same.

P^1 are clamps for holding bevelled shape blocks of carbon, P P, in position, the arrangement being

such that when the solenoid core, N, is held in its upper position under the influence of an energizing current, the working current will pass from the conductor joining one of the carbon blocks P to and through the contacts 0 0 0, arms o o, and other contacts 0 0 0, to the remaining carbon block, P, and thence to the exposed sectional trolley conductor embedded in the roadbed in the manner well understood.

All of the parts of the switching mechanism are properly assembled in the workshop and placed in position in the enclosing switch box, C.

The cables leading to the switch boxes and to the ends of the magnet coils are bent downward to the side box C^5 as shown, and the cover C is placed thereon with its lower edge resting in the groove C^2, after which this groove is filled with paraffin or any preferred sealing material, thus assuring the fact that all of the operative parts of the switch will be protected at all times and ready for use when they arrive at their destination, where they may be placed in the outer box B^4 after the manner shown in Fig. 2, and the necessary connections made between the several conducting cables.

THE LEAK CIRCUIT.

This invention was the direct result of the frequent recurrence of a "live" section, consequent upon the leakage of current from the high potential button to the low potential or switch button, resulting in the maintenance of the magnetic switch in a closed position and a consequent "live" section after the car had passed, instead of allowing it to open and clearing the section as it should.

By interposing the track rail—i.e., the negative conductor—between these two buttons, electric connection between them was made absolutely impossible except through the motor, hence a switch magnet could only be energized by the motor current—which is, of course, interrupted by the passing of the car—and never by the leakage current, which, being independent of the car, remains as a source of evil. The importance of this provision against accidental electrification of the street, as well as its efficacy as a remedy, is acquiesced in by everyone who has thus far considered the subject.

Diagram B fully illustrates the manner in which the leakage currents are effectually guarded against. Upon examination of this diagram it will be noted that the magnet operating coils are contained in a circuit leading from the track rails to sectional rails placed outside of the same. As the current which energizes the magnets travels in a direction from the sectional rails to the track rails, it follows that any leakage from the sectional service conductors SC^1 SC^3 SC^5, etc., could never reach the outside sectional rails and cause a current to flow from said sectional rails to the track rails by way of the coils, all the leakage current necessarily being absorbed before it passes the negative track rails.

THE INTERCONNECTING FACTOR.

Experiments with the sectional rail system developed the imperative necessity for a "time allowance" for the operation of the switches before demanding current of the successive contact buttons or rails as the car progressed; this demand for time allowance is, of course, increased as the speed is increased. It is a fact that without such provision a car running 10 or 12 miles per hour would "run away" from the current—that is to say, the car would pass over a button so quickly that its switch would not have time to act, and consequently the motor current would not only fail but destructive sparking at the switch contacts would ensue. It is, of course, apparent that in the case of high speed trunk line roads this defect would be fatal. As to the efficiency of the means employed to give the requisite time allowance in a reliable and positive way, it needs only that the fact be stated that the current employed for actuating any given magnet is carried forward to and utilized in actuating the next succeeding one. If, therefore, the current employed is sufficient to energize the first, it must of necessity be sufficient for the next, thus insuring the operating simultaneously with the first and not at some indefinite period thereafter.

The connection, diagram A, will fully illustrate the manner of interconnections between the operating switch coils. For instance, the current will flow (see diagram) from sectional conductor SC^4 through wire W^4, through upper coil of magnet M^2, then by the interconnecting wire W^4 around the lower coil of magnet M^3 to track rail.

MISCELLANEOUS FACTORS.

In the progress of development ensuing from the continuous chain of experiments conducted by us, many deficiencies not otherwise discoverable were made manifest. Among these were the following:

1st. The fact that surface leakage from the high potential button to the track rails would suffice to keep the switch magnet energized if it were in the circuit between the main feeder and the high potential button; this led to a complete reconsideration of the electrical circuits. To remedy the difficulty, the switch magnet was finally placed in circuit between the motor and the track rails, instead of between the high potential button and the motor, thus insuring the absolute isolation of the switch magnet after the passage of the car. This was a new provision against the hurtful effects of leakage, as will be seen from this statement of its specific purpose and function, and quite different and apart from that provided for in the leak circuit.

2d. The fact that the interconnecting feature as originally worked out for street-railway work would not operate with equal efficiency in both directions, and therefore, though fairly satisfactory for street car work, would not at all fulfil the requirements of trunk line work; this led to its further consideration with consequent result of a circuit arrangement affording equally effective operation in either direction.

3d. The fact that when a motor attained a speed which caused its counter EMF. to approximate closely the direct EMF. of the line, the current passing would be so diminished in volume as to be insufficient to keep the switch magnets closed, thus producing an uncertain action with consequently dangerous fluctuations; this led to a consideration of ways and means to insure a fixed minimum current through the switch magnet, independent of and indifferent to the quantity of current taken by the motor. The means finally introduced to effect this object proved upon trial to be positive and reliable in operation; without this provision, heavy traffic lines cannot be operated by a sectional conductor system.

Diagram B, illustrating the leak circuit, will also clearly show the "by-path" feature. Upon examination of this diagram it will be noticed that the current for the motors flows from the positive main through the switch contacts to a sectional conductor and contact shoe through the motors and to the controller where it divides itself—one part of the current flowing by way of the negative contact shoe and sectional rail to and through the switch coils and finally to the rails on the return conductor; the other part flowing through a storage battery of low voltage (charging the same) to the car wheels and to the return conductor. It will thus be apparent that should the current through the motors diminish to any great extent, the current through the battery connection W^{11} will reverse and the battery will supply the additional current needed to safely work the electro-magnetic switches.

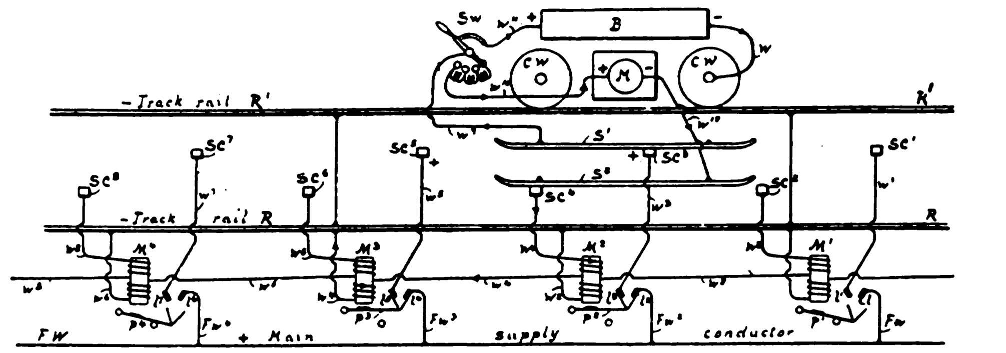


DIAGRAM A.

THE CROSSING PROTECTOR.

Among the many, and sometimes captious criticisms which our work has met with during the period of its development was one condemnatory of the use of a storage battery of material EMF. and current capacity and consequent cost and weight. We employed such a battery at the outset for the dual purpose of operating the magnetic switches and propelling the car over short distances, by the latter function obviating the necessity of electrically equipping crossings, switches, turn-outs and other situations otherwise involving not only expensive construction but great liability to interruptions consequent upon the possible short-circuiting of the conductors at such places. Although we presently gave ear to this criticism as one involving a prejudice not readily combated, we nevertheless adhere to the opinion that such combination of battery and direct supply will yet be found to be an exceptionally economical and practical system of street-car propulsion. However, having decided to concede the objection to be one deserving of our attention, we sought and found the means of dispensing with the battery and at the same time overcoming the liability to interruptions in the event of short circuits. The means discovered for accomplishing this may be expressed in the paradoxical statement that though a short circuit may occur, and the safety fuse be blown

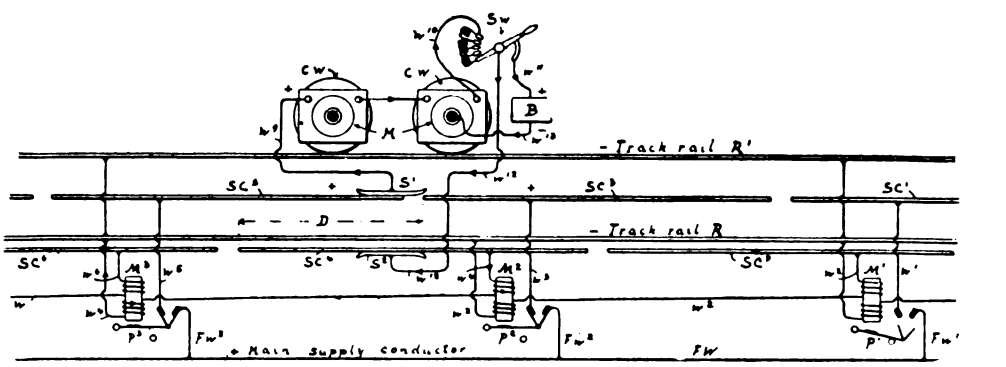


DIAGRAM B

the current will yet flow in sufficient quantity to propel the car off the impaired section and permit its continuing progress without so much as an actual stoppage.

Such a position is imperative in any surface contact system, since in any such system it is impossible to so differentiate the plane in which the positive and negative conductors lie as to render accidental short circuits improbable.

To illustrate this feature reference is made to diagram C where S^1 S^2 represent the trolley shoes which are connected to the motor on board of the car (not shown), R R^1 represent the tramrails of one line of rails and R^2R^2 corresponding lines of rails of a crossing tramway; SC^2, SC^4, etc., represent one line of sectional trolley conductors or contacts, and SC^3, SC^5, etc., represent the parallel line of sectional trolley conductors or contacts. B B represent two of the switch boxes, the circuit connections from the current feeder or main thereto and therefrom to the sectional trolley conductors being identically like those described in the previous diagrams.

F represents the fuse in the switch box, which is designed to "blow" for such current as may be deemed best, and X represents a resistance in a shunt or derived circuit about the binding-post to which the opposite ends of the fuses are connected, the arrangement being such that when any short circuit occurs between either of the trolley shoes, as S^1, one of the sectional trolley conductors SC^5 and one of the crossing lines of rails, as R^2, the fuse will be blown, but the circuit between the circuit connections in the switch box and that particular sectional trolley conductor or contact will not wholly be ruptured, and the sectional trolley conductor when connected through the circuit connection in the switch box will still carry sufficient current to move the car over the crossing to the next sectional trolley conductor in advance.

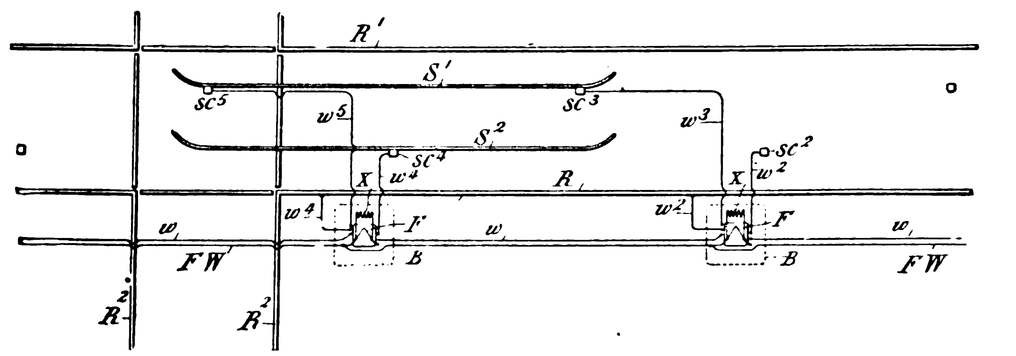


DIAGRAM C.

METALLIC CIRCUIT SYSTEM WITH REVERSAL OF LEAKAGE CURRENTS.

Considerable prejudice against the use of the tracks and the earth as a "return" conductor having been developed through the inefficient methods employed in the early days of the overhead trolley, and great stress being put upon the fact that in the open conduit system the track rails were not used as conductors, we thought it well to evolve, if possible, an alternative system in which the track rails and earth need not be employed as conductors. Our work in this direction is of an eminently practical character, not only retaining all of the good elements of the "track return" system but involving a new feature in the line of securing safety, viz., the reversal of direction of leakage currents from that taken by the motor current in passing through the negative switch, thus guaranteeing the "opening" of the switch and consequent discharge of the current from the street surface upon the passing of the car.

To fully understand the method of accomplishing the above features, reference is made to diagram D, where R R^1 represent the tram rails; SC^1, SC^3, SC^5, etc., one line of sectional rails; SC^2, SC^4, and SC^6 another line of sectional rails, and B^1, B^2, B^3, etc., contact points for delivering the positive current, the arrangement of conductors being clearly shown in Fig. 2, which represents a cross section of the roadbed.

It will be noticed upon examination of the diagram that when the switch M^1, for instance, is open, as shown, the positive main conductor and the negative main conductor are connected only to carbon contacts in the switch itself, there being no permanent connection between the sectional conductors or the tram rails and the negative main.

It will also be noticed that the current for energizing the electro-magnetic switches (see magnet M^2) flows from the track rails through the switch coils to one of the sectional conductors belonging to the row SC^1, SC^3, SC^5, etc.

Any leakage from the contact point B^3 would have a tendency to flow from said point to sectional conductor SC^3, then through the switch coil in the opposite direction, demagnetizing the same, to the track rail and to the positive sectional conductor SC^4, which is the negative service conductor; from which it will be fully understood that any leakage currents, after the car has passed, have a tendency to quickly open the electro-magnetic switch.

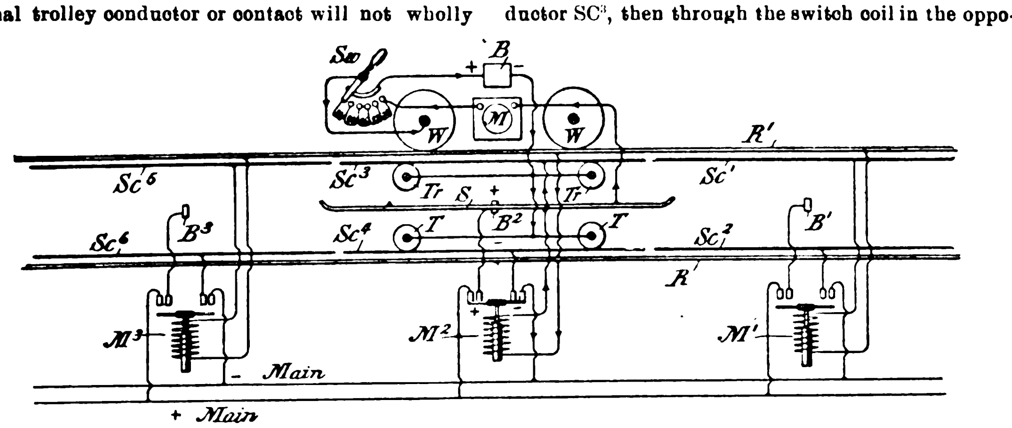


DIAGRAM D.

There has been a deal of superficial talk about the destruction of gas, water and other pipes by vagrant currents from the track rails when these are used as the return conductor. It is true that in the earlier equipments of the trolley roads too little attention was paid to securing a thoroughly good bonding of the rails and otherwise providing for giving them a sufficient conducting capacity, and that under such conditions the electric current seeking a pathway of lower resistance would traverse any contiguous conducting body, thereby causing more or less injury thereto through electrolytic action. When, however, this fact had once been made clearly manifest, additional attention was given to consolidating the rails by electric binding and otherwise, so as to give ample conducting capacity, with the natural result of so minimizing the vagrant currents as to well nigh eliminate their destructive effect; in fact, notwithstanding much that has been said of late upon this subject, it is an open question whether the evil actually exists where intelligent work has been done in laying the track rails. If, however, it is held to be desirable to have an absolute guarantee against such action it is not at all necessary to abandon the simpler system of a single wire conductor and track return and go to the complex two conductor system. It is quite within the electrical engineer's ability to completely eradicate the defect by the simple means of employing asphaltum about the base and sides of the rails when they are laid; the insulation thus afforded, though not of high quality, would yet be ample to care for the comparatively slight tendency of the current to leave the track rails and seek other conductive bodies.

The importance of preserving a smooth and unobstructed street surface is far greater than that of safeguarding a wholly problematical injury to gas or water mains, but there is, I repeat, absolutely no necessity of incurring either objectionable condition. Moreover, the cost of so insulating the rails as to eliminate all leakage would be trifling in comparison with the laying of a system of double conductors.

CONCLUSION.

Having thus encountered and overcome every possible obstacle, whether raised by virtue of our own foresight, the criticism of others or the operation of the system upon experimental trial, we determined to put it in practical operation upon a prominent New York street and prove the complete efficacy of all its factors "in the eye and under the nose" of railway managers, municipal authority and the public at large. This was done, and the demonstration, continuing over a period of eight months, proved conclusively that the system was reliable, economical and safe in all weathers and under all conditions of street surface. The sole criticism—one evolved, by the way, more from a predetermined intent to condemn than upon an honest judgment—was as to the physical obstructions of the streets by the two rows of buttons then employed in the system as the contact points. This criticism had a colorable ground under the conditions with which the work was environed, which were:

1st. The work was done in the winter season with frost in the ground.

2d. The buttons were founded upon the same unyielding base as the track rails in order to keep their top surface in the same plane as the track rails. The pavement in turn was founded upon sand. The inevitable consequence was a settling of the pavement on the disappearance of frost and a consequent considerable protruding of the buttons above the street surface, thus creating an objectionable obstruction to horse and wagon traffic.

The simple remedy for this fault was, of course, to give to the street pavement as complete and satisfactory foundation as was had by the buttons themselves and as is done in cable and open conduit work; but the critics of the system were not seeking light, they were after damnatory points, and though compelled to admit the satisfactory operation of the system, its safety, etc., and even that the buttons would not be objectionable upon the street of a European city where pavements were better laid, they adhered to the conclusion that upon our streets the buttons would be condemned by municipal authority.

While still combating this view and insisting upon the entire feasibility of so consolidating the buttons and the pavement as to maintain their surfaces always in the same plane, we have, neverthe-

less, in pursuance of our policy of confronting every hostile and prejudiced criticism with a complete antidote, sought and found a way and means of dispensing with buttons altogether, substituting therefor simply a single third rail, sectionally divided and so laid as to ensure its perpetual identity with the track rails themselves.

In accomplishing this without abandonment of any of the valuable factors incidental to the button system, Mr. Lundell has evolved an invention which may yet prove to be the "key" to the whole problem, particularly in view of the fact that it not only simplifies the system but materially reduces its cost. A description of this invention unfortunately cannot now be given, as the patents are still pending.

An important quality of the surface contact system is its extreme flexibility. Unlike the open conduit system all its operative parts are on the surface; it is, therefore, entirely feasible to pass at full speed from the surface contacts to an overhead trolley and vice versa. There is no "plow" or other incumbrance to remove.

A storage battery may be likewise combined with the system to operate the cars over unequipped portions of a line. The battery need not be removed from the car for charging as it is being constantly charged while passing over the equipped sections.

The opinions of Lord Kelvin and the late Dr. John Hopkinson, the one the greatest theoretical authority in the world and the other undoubtedly the best authority on practical application of electricity, attest and support the verbal expressions in support of the system made by such authorities as Thomas A. Edison, Frank J. Sprague and others. Dr. Hopkinson, in his advisory capacity as consulting engineer for English and Continental railways, strongly recommended the system to at least one of his clients, who now only awaits Parliamentary action to give it a practical trial.

The railway manager who first applies this system will achieve more in the way of ridding our streets of the objectionable overhead wires than have all the laws that have been enacted for this purpose.

THE ELECTRIC MOTO-VEHICLE.*

BY C. E. WOODS.

It gives me great pleasure to be honored with an invitation to express my observations and experiences in the development of the moto-vehicle before a body of men who have a professional interest in the question involved almost if not quite as keen as my own; for the development of the moto-vehicle—and I would like here to call attention to the fact that the many other names applied to self-propelled vehicles seem to me to be misnomers. Automobile is all right in France. Autocar is probably correct in England, neither one of which, it seems to me, is wide enough in its application for America. Motocycle is misleading, as it throws the mind away from a carriage production, and horseless carriage is brutal to say the least. It retains the memory of the very thing we wish to eliminate and reminds me of a little incident that occurred to a gentleman not long since while running a moto-vehicle on the street. One of our little street Arabs stood on the curb stone and as the carriage rolled by he looked up at the driver and said: "You needn't think you're so much, Mister, for you ain't the only one who ain't got no horse." I think it is desirable in a proposition of this kind to cast out all memory of a condition of affairs which in no wise applies to a new means of propulsion—as well say "horseless" when speaking of the trolley car. Moto-vehicle, a term which I have used almost exclusively in my business, seems to be a name that covers the whole field in this work as it implies any form of motor power or any class of vehicle construction to which such power may be applied, and I sincerely trust to see its general adoption in the near future.

But to resume: The development of the moto-vehicle has been an engineering proposition pure and simple both in its electrical and mechanical phases, points in which have required the same careful consideration for operation, cost of production, adaptability and utility as all other engineering propositions of the day have required; and it is not, as many suppose, confined to the narrow realms of mere invention. The prime principles employed in the construction and operation of a moto-vehicle are units well known in all other classes of engineering work, and it has been an adaptation of already existing elements to a new purpose rather than the creation of anything new in its entirety for some specific purpose; in addition to which, the carriage-maker's art has had to be investigated and the various styles, finish and contour used by it harmonized with a new condition of affairs in carriage building and designing. In this particular, I wish to express very briefly my experience, which has covered some three years and which has been gathered from all classes in my efforts to locate and predicate a market for moto-vehicles.

The development of this is not confined, as many suppose, to the creation of one or two types of vehicles to which power may be applied with the idea that, a la bicycle fashion, they would fill the requirements of the market. The cost of these vehicles necessarily demands solicitation for business from a class of people who have been users of fine carriages to a greater or less extent, and unless they can have the same diversity of design, the same luxury of appointment and finish, and the same easy riding carriage that they have always been habituated to, the proposition does not meet their wants and the market becomes limited. My work, and I notice that of others, is now towards the development and perfection of a general line of vehicles rather than toward some one or two specific forms of so-called machines. As a general thing, the less the word "machine" is used in the market the more satisfactory it is to the prospective purchaser, for he buys his carriage not because it goes without a horse, not because he wants conspicuousness or novel advertising on the street, but because he wants a carriage for himself and family to ride in in exactly the same sense that he has always purchased a carriage; and his first attraction to and admiration for a moto-vehicle is its independence of manipulation, its more rapid transit, and the refinement attaching to the use of such a vehicle by the absence of anything in the animal kingdom as a propelling power.

In the commercial world its economy and utility are the prime factors for consideration, though at the present moment some considerable importance is attached to its value as an advertising medium; but this valuation is a very unstable affair and will have a very short life, and the real question with the merchant is the economy of using these vehicles as compared with already existing conditions. Unfortunately, experience of any magnitude in this direction has not, as yet, been acquired, although from present results some few figures can be fairly well estimated which will be given further on.

As one looks over the colossal achievements of engineers in the last fifty years and the industrial revolution which they have brought about, and then in connection with this thinks of the still undeveloped possibilities in all directions, it is very hard to think of the moto-vehicle and its future without at times indulging in a little speculation as to its ultimate issue and the bearing it will have on both domestic and commercial life; and if its development, adaptation and application are to be in anything like the ratio that applied electrics have shown in the last ten years, speculation almost unconsciously becomes to us a reality when we consider the conditions as they now exist and compare them with the conditions which may be made to exist by its general introduction and adaptation.

To illustrate: Twenty thousand carriage-makers are required to-day to fill the market demands for vehicles in this country as required for road and street transportation. A little over 30 per cent. of the total animal power used in this transportation is required in the cultivation of the soil to obtain fuel for this power and to transport such means of maintenance and stable refuse from point to point. This means, broadly speaking, that animal power has in itself but about 70 per cent. efficiency in its application. Further, horse power cannot be worked at a greater average than about five hours or twenty miles per day, which as compared with mechanical applications of any form puts such power into a very low figure of utility. Under such conditions of operation, this power unit has a depreciation of not less than 20 per cent. per annum, and from large users of horses in express companies, large liveries, etc., the depreciation has been given me as about 33 per cent.—either of which figures is far in excess of any of our good mechanical or electrical propositions of the day.

These startling facts and figures bring us very close to an understanding of the possibilities for the moto-vehicle as an industrial feature, and we cannot under such circumstances deny the brilliant outlook it has for the future. The sanitary conditions attendant on its use, its lesser cost of maintenance, its greater mileage capacity, its more rapid transit, its lesser space occupied in the stable and on the street, its freedom from expense when not in use, all put together retires entirely the objections which at first appear as to its greater initial cost. The possibilities this vehicle opens up for road and street improvement and the low cost of maintenance of same should be items of great interest to municipalities, counties and States. Streets will have a capacity for double the amount of vehicles without any increased congestion, will be freed from the continual pecking of iron feet which are the main causes of their rapid deterioration, and sewers will perform their functions without being continually clogged up with refuse matter. With iron feet removed and rubber tires introduced exclusively, road and street construction should be reduced to one-half and maintenance to one quarter of its present cost. By this, the possibility of building and maintaining a roadway across country from city to city on which only such vehicles in connection with bicycles will be allowed to run becomes patent to our understanding, and the day will come when States and counties will be called upon to consider such roads. But to come back from speculation to reality. The greater first cost of these vehicles is a necessity which is very readily understood, as the vehicle part itself, for a first item, is necessarily more expensive for the reason that when it comes to carrying twice or three times the vehicle ordinarily carried, to running it twice or three times as fast as the horse drawn vehicle under exactly the same conditions of road and street, it means quite a different proposition in vehicle construction without reference to its electrical and mechanical features.

The necessity and durability of rubber tires for traction, noiselessness and protection to motors and batteries goes unchallenged, as does the absolute necessity of reducing all friction losses by the introduction of either ball or roller bearings in all of the moving parts; all of which are much more costly than ordinary carriage construction, but by virtue of which depreciation is very much reduced over the ordinary vehicle and an interchangeability made practicable in all of the wearing parts. These conditions, coupled with the first cost of motors, batteries and et ceteras, will never put the selling price of the moto-vehicle on a par with the hundred dollar buggy, as some people seem to imagine the dim future holds a possibility of, but will put its durability far in excess of such vehicle.

In reviewing conditions in other directions that

* Read before the Chicago Electrical Association, Nov. 18, 1898.

have led up to a possible perfection of the moto-vehicle, we can almost trace a sort of evolutionary wheel within a wheel progress that has all the time been tending toward its development. Other means of conveyance than by animal power, as by railroad, street car and bicycle, have given birth to a desire on the part of the public for any and all kinds of mechanical conveyance. With this came the perfection of rubber tire application on vehicles, which were first used for their noiselessness and which made possible the introduction of ball bearing axles, into carriage construction—two features without which the application of motor power would be almost prohibitive.

With the perfection of this came a gradual development of the moto-vehicle in its many phases, until to day we have what can be pronounced a successful issue in its practicability with an ever-increasing inquiry and demand from all over the world concerning its use and adaptability to personal and commercial wants.

This development, like all other propositions of kindred nature, was necessarily experimental in its initial steps and unfortunately led to many premature and erroneous conclusions regarding possibilities in its use and for a long time was not considered susceptible to any general application, and while with some people this first false impression has been retained, as a general thing its wide range of possible usefulness is well conceded, especially by the engineering fraternities of the country.

(To be continued.)

Carbon Arc Vapors.

Messrs. E. Merritt and Oscar M. Stewart give in the current number of the *Physical Review* some most interesting experiments on the conducting properties of the vapors arising from the electric arc between two carbon points. In the series of experiments carried out by the authors, the known properties of gases ionized by the action of X rays were kept in view in order that the resemblances and differences between the two classes of phenomena might be brought out. The various experiments in discharging electrodes by means of the arc vapors, and as to the length of time which their properties required, are too long to refer to in detail. The results of the experiments, which the authors consider as preliminary only, says the *Electrical Engineer*, London, may be briefly summarized as follows:

(1) The vapors from the carbon arc possess the power of discharging electrified bodies with which they are brought in contact. In general, the electrical properties of these vapors are similar to those of gases that have been acted on by X-rays, or to the gases from a flame. Except at low potentials the rate of discharge is not proportional to the potential, but approaches a limiting value as the potential is raised. (2) This discharging power is retained even after the vapors have been passed through long tubes of glass or metal, and lasts for at least 10 seconds. (3) When caused to pass between a charged conductor and one that is grounded, the vapors in large part lose their conducting power. A similar result is obtained by passing the vapors through loosely packed asbestos wool. (4) After passing between two grounded conductors, these being only a short distance apart, the vapors are found to discharge a negatively electrified body more rapidly than one charged positively. In this respect their behavior is similar to that of gases that have been ionized by the action of X-rays.

The explanation of the phenomenon is probably that suggested by Zeleny—namely, that the negative ions diffuse more rapidly than the positive ones. (5) Positive and negative charges are in general dissipated by the vapors with equal rapidity. But experiments made with a vertical enclosed arc show that gases taken from near the lower carbon have unequal discharging powers for the two electricities; in this case that charge which is of the same sign as the lower carbon is dissipated less rapidly. This is true whether the lower carbon is positive or negative; and the effect is not altered by connecting either carbon with the earth. (6) If air or oxygen that has been saturated with water vapor is introduced into the enclosure containing the arc, the conducting power of the arc vapors is greatly increased. But this effect can no longer be observed when the body to be discharged is at a considerable distance from the arc.

LONG DISTANCE TRANSMISSION OF POWER.*

BY C. RICE DOOLEY.

So rapid has been the growth of manufacturing industry in the United States that the subject of power has become one of vital importance. For years the direct utilization of the power of waterfalls and steam plants has been almost the exclusive practice in operating factory tools. To these animal power has given way. Are we finally to see the electric current supersede steam?

Since the advent of greatly improved machinery for developing electricity, engineers have given more attention to this force. Until within the last decade the transmission of electric energy over long distances was not practicable, therefore prior to this time the electric generator with its source of power had to be located near the place of power consumption. This, of course, necessitated the use of an engine, excepting in a few cases, where water power could be obtained, and as available water powers are comparatively scarce, the demand for steam engines was materially affected. For this reason every small lighting plant and every electrically operated factory had to be fully equipped with its own source of power. The advantages of such an arrangement are not great, for the engine that drives the dynamo must be of sufficient power to do the work which the electric current performs; therefore it is more economical for the small factory to apply the power of the engine directly to the machine tools. However, in large installations, the convenience of distributing power through wires over that of mechanical appliances often warrants the use of electric power, even where an engine has to be maintained to supply the mechanical power for generating it. It is evident, therefore, that for small shops and factories electricity could, in the past, have been of no benefit unless these establishments were fortunately situated near water powers.

With the development of larger and more efficient dynamos the effort has been to establish central power stations for transmitting energy electrically over large territories. This system has attained its highest development in the harnessing of natural cataracts.

In speaking of electric energy the engineer thinks of two things: First, the amount of electricity flowing through the wire; second, the force with which it is being driven along. This force is commonly known as voltage, while we will refer to the electricity flowing as the current; thus we speak of a certain current transmitted at so many volts. By experiment we know that the main loss of energy is due to heat radiation from the transmission lines. Also, it has been demonstrated that this heat varies directly as the resistance offered to the current and as the square of the value of the current. From this we see that if only a small amount of current is conducted the per cent. of loss is very much reduced; the problem is, then, to transmit the electric energy in the form of a small current and at the same time provide for the development of a large amount of power where it is to be utilized. To do this the practice is to generate an electric current at a moderate voltage and, by means of suitable apparatus, convert it into a small current at high voltage. This high voltage current is transmitted to the point of utilization where the electric energy undergoes a reverse transformation which brings it to its original condition and to one much better adapted to the propelling of machinery.

The use of a small current at high voltage is analogous to that of a small water pipe conveying water under high pressure. Suppose two pipes varying widely in diameter to conduct water from "a" to "b." Now, in order to transmit the same volume of water by each in the same time the water in the small pipe must evidently have a much greater pressure, or rather velocity. These two pipes may be made to fill two equal reservoirs in the same time and thus each made to do the same work. Just so in the case of electric transmission; the same power can be conveyed either by a large current at low voltage or by a low current at high voltage, but as the heating is much less in the latter case it is the method that is commonly used—in fact it has rendered the long distance transmission of electric energy possible.

Upon this principle the great long distance power transmission plant was constructed at Niagara Falls. Nature has concentrated a vast amount of energy at this one point, and at last man has succeeded in developing a practical method for its distribution, in part at least. In the year 1894 the Niagara Falls Power Company saw the completion of its great project, and now this plant furnishes almost the entire city of Buffalo, over twenty miles distant, with electric power. The generators produce a current at 2,200 volts which is transformed to 11,000 before leaving the plant. Then at Buffalo the voltage is reduced to 500, at which pressure the electric energy is used to drive the street cars of the city, for lighting purposes and for local distribution. Although the Niagara plant was by no means the first of its kind, or even the first for the purpose of long distance transmission, yet at one time it was by far the largest one and operated on such a large scale that the era of long distance transmission lines will doubtless be properly dated from the time of its completion. Since the completion of the plant many factories have located near Niagara, and among these we find "The Niagara Electro-Chemical Works" and the aluminum factories which use the current directly in obtaining this product; also "The Buffalo Railway Co." employs the Niagara power to drive its street cars.

The success of this great power plant seems to have decided the question of central stations driven by water power, for scarcely a season passes without the periodicals containing detailed accounts of late water power generating plants furnishing electric current at high voltages within a radius of several miles. We find them all over the United States; for instance, at Lewiston, Idaho, a town situated on the Asotin river, is quite a large station. The stream has a fall of sixty-five feet to the mile and by means of conducting channels the water is made to descend perpendicularly one hundred feet on the turbines. The current generated is transmitted at ten thousand volts and at the terminals of the line is used at five hundred volts to drive machinery and for lighting purposes. Again we find another on Apple river in Wisconsin. There the current is generated at six thousand volts and transmitted directly from the machine for a distance of seven miles where the voltage is reduced to two hundred. This power is largely used to operate grain elevators as well as for lighting purposes. We also find many such plants in the Eastern States, and one I would especially mention is located on the Hudson river about seventeen miles from Schenectady, N. Y. Schenectady is the location of the largest electrical manufactory in the United States, and the entire institution was until recently entirely operated by steam. The electrical energy is transmitted from the Hudson to Schenectady at a voltage of ten thousand.

But the United States is not alone in this advance-

*From *The Purdue Exponent.*

ment, for we find extensive generating plants in other countries; for instance, at Kootenay, B. C., twenty-five thousand horse power is generated by turbine wheels. The energy is conducted thirty-one miles at twenty thousand volts pressure and then reduced to twenty hundred for commercial purposes. Even in Brazil, S. A., we find a few central power stations. One is operated by a one hundred and fifty foot water head which transmits the current at four thousand volts for several miles where it is used to propel a street car system.

Many other interesting plants might be cited, but these few will show the favor with which this scheme of power transmission is meeting. Centralized power is undoubtedly the best method of making electricity the servant of all institutions both great and small.

Electrical Haulage on English Canals.

The system of electrical canal haulage which is about to be tested on one of the Northern canals by a Westminster firm, says *Industries and Iron*, is of some interest. In it the motors are independent of the barges, for they haul them by means of ropes. An aerial railway consisting of two steel rails braced together and supported at a height of 9 ft. or 10 ft. above the towing path by means of cast iron brackets, at intervals of about 30 ft., is laid along the canal banks. This is the running track for the electric hauler, which consists of a motor mounted on a four-wheel carriage. Two of the wheels run on the upper surface of the rail and two beneath. All the wheels are drivers. The motor is of the ordinary direct-current series-wound type. The tractive force required to tow a barge carrying 100 tons on a canal of ordinary cross-section at the rate of $2\frac{1}{2}$ miles per hour is from 250 to 300 lbs. The brake horse-power is thus—

$$\text{B. H. P.} = \frac{2.5 \times 5{,}280 \times 300}{60 \times 33{,}000} = 2.$$

But the hauling apparatus must be able to extort 600 lbs. and would weigh 300 lbs., and the weight of the motor or carriage would not exceed 900 lbs. The estimated cost by horse haulage at $2\frac{1}{2}$ miles per hour is .077 penny per ton per mile, and the cost of electrical haulage .032 penny per ton per mile.

A Trolley System for Paris.

The municipal authorities of Paris have up to the present set their face against the introduction of the trolley, so the *Electrician* of London informs us. The line from Aubervilliers to the Place de la République runs only as far as the fortifications on the trolley system, but a new line from Charenton to the Bastile has now actually brought the trolley wires within the gates of the city.

The length of the line is 3.8 miles, and it is all on the overhead trolley system, with the exception of two sections, aggregating half a mile, on which the underground conduit is employed. Three Thomson-Houston compound-wound generators (one serving as reserve), each of 150 kilowatts capacity, furnish the power. These are driven through belting by single Farcot non-condensing engines. The station pressure is 550 volts. Three semi-tubular Meunier boilers, with a heating surface of 6,500 sq. ft., furnish steam at 100 lb. per square inch pressure. These boilers work under forced draught on M. Prat's system, and a chimney 56 ft. high is found amply sufficient. There is a battery of 250 cells, with a capacity of 350 ampere hours, used for supplying the conduit sections of the line which are electrically isolated from the remainder. The battery is charged by one of the generators, a special switch being provided to short-circuit the series windings.

The track is double throughout, made up of 90 lb. rails with Falk cast-welded joints. In nearly all cases the posts supporting the trolley wire are in the center of the street and span wires are not used. The posts each carry two 5 ampere arcs on brackets, the lamps being connected five in series across the terminals of the battery. The conduit part of the lines is similar to that in use in Ninth street, Washington, with a slot 1 inch wide. There are in all 18 cars, with single-reduction motors, and differing but little from the usual Thomson-Houston construction.

THE WARREN ELECTRIC & SPECIALTY COMPANY'S PLEASANT OPENING OF A NEW FACTORY.

The *Daily Chronicle* of Warren, O., gives the following account of the pleasant entertainment furnished by the Warren Electric & Specialty Company to their employes to celebrate the opening of an important annex to their works:

"Ever since the formation of the Warren Electric & Specialty Company the good feeling between employer and employe has been a matter of note. Each year the company in some way manifests to its employes the existence of a special interest. The management recently saw a chance to give every employe a pleasant evening of enjoyment, and accordingly the plan was carried out. The company have just erected a large two-story building to be used for a machine shop and the manufacture of electrical apparatus. The programme was to dedicate this building by giving a supper to the entire force, to be followed by a dance, and it was carried out to the dot. At 5:30 on the night of the 22d inst. the 128 employes filed into the impromptu banquet room and took seats at the tables. Officials of the company and several other stockholders, accompanied by their wives and children and a few friends, were seated at the center table. The Anti-Trust football team filed in and took their places at a specially arranged table. Previous to sitting down they yelled their football slogan which is:

> "Win we will, win we must
> For we belong to the Anti-Trust.
> Rah! Rah! Tiger, Sis. boom ah!
> W. E. S. Company—Rah! Rah! Rah!

"The ladies of the Friendly Union served an excellent repast, and all did justice to the tempting viands.

"Pres. T. H. Gillmer was called upon for a speech and responded in part as follows: 'Six years ago, or on November 19, 1892, the Warren Electric & Specialty Company was organized; there were not many present at the christening, only six. Soon we began business, and at first we had but few employes on the pay roll—which was lucky for us; but during the years we have steadily increased our business and now have 128 persons on the roll—and I am informed that I am not included in the number. For 300 days in the year you work hard; you do the duty assigned, and so far you have been satisfied to do the work given. I think a company that appreciates the work of its laborers will lose nothing by giving them an entertainment of some kind, as we have done to-night. Such firms succeed. I am not egotistical when I say this firm has succeeded, that our business has increased; and this is due greatly to the aid and co-operation you have given us. We have had no labor trouble and we hope it will continue thus. We have planned further amusement for you upstairs and hope you will enjoy yourselves, for by so doing you will please us. I thank you.'

"Three rousing cheers were then given for the Warren Electric & Specialty Company and its officers."

Dancing followed, and a cake walk, recitations, etc., added to the enjoyment of the merry gathering.

Proposals Invited.

The U. S. Navy Department, through the Bureau of Yards and Docks, is inviting sealed proposals until December 17 for extending the electric light system at the New York Navy Yard. At the same time and place proposals will also be received for enlarging the wiring system at the same Navy Yard. Specifications, blank forms of proposal, a wiring plan and a general plan will be forwarded to prospective bidders upon application to the Bureau of Yards and Docks, Washington, D. C., or to the Commandant of the U. S. Navy Yard, Brooklyn, N. Y.

The Interior Department, through the office of Indian Affairs, is inviting sealed proposals until December 20, for furnishing and delivering the necessary materials and labor required in the construction and completion of an electric light plant at the Indian Industrial School at Mt. Pleasant, Mich. Plans, specifications and instructions to bidders may be examined at the Indian Warehouse, 1,602 State street, Chicago; the Builders & Traders' Exchange, Omaha, Neb., and at the school. Any additional information may be obtained upon application to W. A. Jones, Commissioner of Indian Affairs, Washington, D. C.

American Institute of Electrical Engineers.

The 129th meeting of the Institute was held at 12 West 31st street, New York, on Wednesday evening, November 23, President Kennelly in the chair. The paper of the evening, on "The Design of Transformers," by F. W. Carter of London, England, was read by Prof. W. S. Franklin of Lehigh University in the absence of the author. It was discussed by Messrs. Franklin, W. B. Jackson, Wolcott, Henshaw, Torchio and others.

At the meeting of the Executive Committee in the afternoon the following associate members were elected:

Cleveland Abbe, Professor of Meteorolgy, Weather Bureau, Washington, D. C.

John Cassidy, Superintendent Mutual Telephone Co., Honolulu.

James Francis Cosgrove, Head of Locomotive Engineering Department International Correspondence School, Scranton, Pa.

Donald Hume Fry, Assistant to Robt. McF. Doble, San Francisco.

James Hamilton, Patent Attorney and Expert in Patent Causes, Boston, Mass.

Bernard Hoffman, New York Telephone Co., New York City.

Harry D. James, Expert Draughtsman, Otis Bros. & Co., Yonkers, N. Y.

S. L. G. Knox, First Asst. Engineer, Crocker-Wheeler Electric Co., Montclair, N. J.

Howard Wallace Leitch, Switchboard Regulator, Edison Elect. Illuminating Co., Brooklyn, N. Y.

R. W. Lohmann, Electrical Engineer, Oakland, Cal.

C. Stowe Reno, Electrical Engineer, Triumph Electric Co., Cincinnati, Ohio.

R. H. Sperling, Assistant Engineer, British Columbia Electric Railway Co., Victoria, B. C.

James Wilkinson, Station Manager and Chief Engineer, Consolidated Electric Light Co., Birmingham, Ala.

A. Wilford Zahn, Electrical Engineer and Supt., Manhattan Light, Heat & Power Co., St. Paul, Minn.

The following associate members were transferred to full membership:

Franklin Robert Anson, Secretary and Manager, Salem Light & Traction Co., Salem, Oregon.

Sidney Hand Browne, Consulting Electrical Engineer, Baltimore, Md.

A. E. Brooke Ridley, Agent & Electrical Engineer, Siemens & Halske Electric Co., San Francisco.

The Committee on Co-operative Research having completed the first stage of its work, has sent various collegiate electrical engineering departments an explanatory circular submitting twenty-seven subjects for investigation.

An Electrical Exhibition in 1899.

We have received the following announcement for publication:

Editor ELECTRICITY.

DEAR SIR: At the annual meeting of stockholders of the Electrical Exhibition Company, held on the 21st inst., it was unanimously decided to hold another Electrical Exhibition in this city in 1899.

The following officers and directors were elected: C. O. Baker, Jr., president; F. W. Roebling, vice-president; Geo. F. Porter, secretary and treasurer; Marcus Nathan, general manager; H. H. Harrison, L. F. Requa, J. W. Godfrey, C. A. Lieb. Very truly yours,

ELECTRICAL EXHIBITION CO.

New York, Nov. 22, 1898.

LEGAL NOTES.

The Supreme Court at Jefferson City, Mo., has declared invalid and inoperative the Julian public franchise law (for the sale of franchises by the city). The decision was rendered in the quo warranto case against the West Side Electric Railway of Kansas City, wherein the Attorney General of the State brought mandamus proceedings against the street railroad company to compel it to show why its franchise had not been granted under the provisions of the Julian law. The opinion, which was written by Judge Williams, declares the law is inoperative because it is indefinite and vague in its provisions. The act of the court in knocking out this law precludes the sale of street railroad, telephone, telegraph, and in fact all public service franchises by the city.

The Supreme Court of Oregon held, in the case of Perham vs. Portland General Electric Company, that the doctrine that the placing of electric wires known to be dangerous at a place where others are lawfully entitled to be constitutes negligence was properly applied to wires strung over a bridge where workmen in repairing the bridge came in contact with them, and that the apparent perfect insulation of the wires amounted to an invitation to risk contact with them when the wires were placed where persons while performing their duties might come in contact with them.

The Court of Appeals at Frankfort, Ky., on the 23d inst., affirmed the judgment of the Franklin Fiscal Court in the corporation indictment cases. Indictments were filed in the lower court against 120 of the largest corporations in Kentucky, including express, telegraph, telephone, water, gas, street car, electric light, bridge and other corporations, for failing to file reports and schedules of property in that State and business done. The statute provides a penalty of $1,000, and $50 a day additional for each day of such delinquency. The lower court returned verdicts for the State and the Court of Appeals sustains the verdicts, holding that the statute is constitutional and that failure to report is a violation, and that the corporations cannot be excused on technical grounds. The decision will eventually amount to more than a half million dollars in fines to the State, and it is said by the management of some corporations will amount to confiscation of their property and force them out of business.

The Appellate Division of the New York Supreme Court for the Second Department held, in the case of O'Flaherty vs. Nassau Electric Railroad Company, reported in New York *Law Journal*, that the falling of a trolley wire into the street raises a presumption of negligence on the part of the company which maintains such wire that will create a liability for injuries sustained by a passer-by unless the conditions are satisfactorily explained so as to overcome such presumption of negligence, and that the testimony of the defendant's employees regarding a system of inspection of such wires will not relieve the defendant of this presumption of negligence as matter of law, but that the witnesses being interested persons who might have a motive of shielding themselves from blame their testimony presents a question for the jury. The court further held that where the testimony shows the use of an automatic device for cutting off the current when a wire falls to the ground the communication of a shock to a passer-by will authorize a finding that such appliances were not in working order at the time of the accident.

The Kings County Electric Light and Power Company.

The Brooklyn *Eagle* says: "The management of the Kings County Electric Light & Power Company has decided to retain General Superintendent F. S. Barstow of the Edison Electric Illuminating Company as general manager of the recently consolidated company. Mr. Barstow has been for many years connected with the Edison Company and has an enviable record for his thorough knowledge of the electrical business as well as for executive ability of a high order. E. F. Peck, who has been the secretary of the Kings County Company, has been appointed assistant general superintendent. Mr. Peck has been interested in electric matters in Brooklyn for years and has been connected with the Citizen, Edison and Kings County Companies. No other changes in the personnel of the management will be made for some weeks and not until the report now being prepared by A. M. Young has been presented and acted on by the Board of Directors. The changes contemplated, however, are said to be radical in character and will be in the line of greater economy in management."

CANADIAN NOTES.

Mr. C. J. Ballantyne of Honolulu, formerly a resident of Ottawa, is now in the latter city. He left Ottawa and went west in 1882, finally locating in Honolulu. Recently he organized a company and bought the franchise to operate an electric railway in Honolulu. He is now on a visit to the leading American and Canadian cities with the object of purchasing a plant and also studying the systems upon which electric roads are operated. Speaking of Hawaii, Mr. Ballantyne said that the people are well satisfied with their status under American protection, and he feels sure that the country will progress at a much greater rate than previously.

The Metropolitan Electric Company will be supplying electric light, power and heat to the city of Ottawa probably by the end of March next. The survey of the company's water power at the Britannia Rapids, about ten miles from Ottawa, has been completed, and everything is now ready for the work of constructing the power house and arranging for the transmission of electricity. Tenders have been called for and about the first of December operations will be started. The Metropolitan Company has two lines under construction for the transmission of the electricity. Only one of these, however, will be operated at present. Through a point of land on the Ontario shore of the Ottawa river which juts out into the Britannia Rapids a canal about 125 yards long and 20 feet wide will be made. At the foot of this canal will be built the power house, and the water from the rapids will be concentrated in the canal.

The Lunenburg Gas Company, of Lunenberg, Nova Scotia, is changing its electric plant from steam to water power. It has a 16 foot dam nearly completed on the Mush-Mush river at Mahone, eight miles from Lunenburg. The pole line is completed and is said to be the finest in that part of Nova Scotia. The water wheel is from the works of the S. Morgan Smith Company, York, Pa., and is one of their well-known "New Success" turbines. The company will light the town of Mahone in addition to supplying light and power to Lunenburg.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILWAYS.

Akron, O.—Gen. Samuel Thomas, of New York, president of the Akron Street Railway & Illuminating Company, who was here a few days ago, stated that the property of the company would be sold next month and the receivership terminated.

Attalla, Ala.—It is stated that Capt. J. M. Elliott, Jr., the owner of the dummy line running between Attalla, Alabama City and Gadsden, has made arrangements to convert the line into a trolley road, the power for which will be furnished by the Alabama Electric Power & Light Company.

Belding, Mich.—The Grand Rapids & Belding Traction Company have filed with the city clerk their acceptance of the franchise granted them by the Belding city council recently, under the terms of which they must have the road in operation inside of a year. The next step is to get a franchise in the city of Grand Rapids, which may cause some trouble.

Camden, N. J.—The promoters of the new elevated electric railway between Camden and Atlantic City have withdrawn their application for a franchise, owing to the opposition developed in the city council.

Chattanooga, Tenn.—Bonds to the amount of $200,000 have been issued for the construction of an electric railway line from this city to Chickamauga Park.

Derry, N. H.—At the coming session of the Legislature an attempt will be made to get a charter for an electric railroad running from Nashua through Londonderry to Derry.

Denver, Col.—There is some talk of the revival of the Lookout Mountain railway scheme. The top of Lookout Mountain is a most attractive place for a suburban resort. So fine a site for summer cottages is not to be found anywhere else near Denver. It is up among the pines and an electric line reaching the summit would place residents of the city within forty minutes' ride of the mountain top.—United States Commissioner Hinsdale has set a date for the sale of the Denver City cable and West End electric lines, which is December 15.

Jackson, Miss.—Work on the electric street road, after many unavoidable delays, has at last begun and will be pushed to completion. The Tennessee capitalists who are behind the enterprise expect to spend more than $100,000 on the car line and lighting systems, for both of which they hold a franchise.

Lincoln, N. J.—Silas D. Drake is the projector of a trolley road from Lincoln to Mizzen Peak, for which he asserts that he has secured right of way and also that the necessary funds are ready. Mizzen Peak is a high point in the first ridge of the Watchung Mountains and lies right back of Bound Brook. It is a beautiful place with a magnificent view and cool mountain breezes in the summer time. Mr. Drake's plan is to run a trolley road up the side of the mountain and convert Mizzen Peak into a summer home for New York business men.

Marysville, O.—The company which proposes to build an electric road to connect Marysville, Pharisburg, Magnetic Springs, Richwood and Delaware and later to connect with Columbus, has completed its organization by electing the following officers: W. A. Wright, president; J. P. Eubanks, secretary, and R. C. Turney, treasurer. Stock subscriptions will be immediately raised and the work on the road will begin about the first of April.

Niles, Mich.—The city council has granted the Michigan-Indiana Street Railway Company a thirty-year franchise to operate and maintain a street car system. The line, as proposed, is to run from South Bend to Benton Harbor, through Niles and Berrien Springs. According to the terms of the franchise the system must be completed within two years.

Northport, L. I.—It is reported here that the Long Island Railroad Company is going to build a trolley line between this village and the depot. Three of the officials recently visited Northport and were driven over the proposed route.

Peoria, Ill.—The long controversy over the leasing of the lake front to the railroads was brought to a close a few nights ago, when the city council, by a vote of 10 to 4, leased that ground to the Peoria & Pekin Traction Company and the Rock Island road for a term of fifty years. The city receives $500 a year and $500 a year for each additional railroad which may use the terminals. It is expected that four or five roads will come in.

Tacoma, Wash.—New York parties have been corresponding with some of our enterprising citizens in regard to a fast electric railway line between this city and Seattle, and it is believed the project will be carried out.

Utica, N. Y.—The Utica & Suburban Railway Company, having obtained a franchise from the highway commissioners, has put gangs of men at work on the construction of the electric railway which is to connect Utica and Rome.

Waterville, Me.—An effort is being made at Oakland to interest capital in the construction of an electric road from that village to this city, and the scheme is finding favor among the people. The argument is that ample and safe water power can be secured at Oakland, that the road would be only a little over five miles in length and that it could be operated at no greater expense than the one from here to Fairfield.

Wheeling, W. Va.—Steps are being taken to secure right of way for an electric road from Steubenville to Martin's Ferry, connecting with the Wheeling Railway at the latter point. The line will run twenty miles in a district well inhabited, connecting Wheeling, Bellaire, Bridgeport, Martin's Ferry, Yorkville, Highland City, Tiltonsville, Warrenton, Rush Run, Brilliant, Mingo and Steubenville.

Wichita, Kan.—A few men and teams have been put at work on the electric street railroad for which H. B. Church was granted a franchise several weeks ago. The work is under the direct supervision of manager W. O. Church.

Zanesville, O.—Judge Taft of the United States Circuit Court at Columbus has ordered the sale of the Zanesville Electric Railroad on January 3 next. Will Christy was appointed special master to make the sale.

LIGHTING.

Bellefontaine, O.—The Big Four railroad company will put in and operate an electric light plant of its own at its shops in this city and will light the yards, crossings, depot, offices, etc.

Bradford, O.—The electric light plant, which has been shut down for some time, was purchased on the 19th inst. by L. A. Dye, who will commence running it as soon as repairs are made.

Cincinnati, O.—A resolution requiring the Edison Company to put recording voltmeters upon its various lighting circuits in this city was presented at a recent

meeting of the lighting board and was referred to the committee on law.

Flint, Mich.—The People's Electric Light Company of this city intends to increase the capacity of its plant from 3,000 to 8,000 lights. The improvements contemplated will cost about $25,000.

Gadsden, Ala.—The Alabama Light & Power Company has been granted permission to construct and operate a light and power plant in Gadsden. The power house will be equipped with the very latest machinery and will cost $25,000. W. S. McCabe is president of the company.

Gainesville, Ga.—James P. Edwards of Augusta is making investigations as to the advisability of putting in an electric lighting plant in Gainesville. If he is assured of sufficient patronage he will erect a plant.

Greenfield, Ind.—The city council has purchased the plant of the Greenfield Electric Light & Power Company, paying therefor $16,000.

Hackensack, N. J.—The Hackensack Gas & Electric Company has absorbed the Englewood Gas Light Company, paying at the rate of $250 a share for the stock. The business of the company will be extended and gas and electric light will be furnished to a number of villages in the neighborhood of Englewood.

Houston, Tex.—The application of Blake Dupree, receiver for the Citizens' Electric Light Company, to purchase a new site for the location of the proposed new Citizens' electric light plant, has been granted by Judge Bryant of the Federal Court and the property will be purchased at once when the work of constructing the $150,000 plant will be begun. This plant will be of a capacity to furnish the entire city with electric lights.

Indianapolis, Ind.—The Chenoweth Electric Light & Power Company has made application to the Board of Works for permission to erect poles and wires for electric lighting outside of the mile square. D. A. Chenoweth, a member of the company, informed the board that the company intends to do commercial and domestic lighting.

Lawton, Mich.—A short time ago Lawton voted to bond the town for $5,000 for electric lights. It was carried by a large majority and the bonds were sold to the First National Bank of Paw Paw. Upon further examination the buyers of the bonds refused to take them because the election was held less than fourteen days after notice as is required in such cases by law. Another election is called for November 30.

Milwaukee, Wis.—C. E. Estabrook has sold the South Milwaukee electric light and power plant to a company known as the South Milwaukee Electric Light & Power Company. The sale includes all the machinery, franchise, etc. The price paid by the new company is said to have been in the neighborhood of $20,000, which was about the figure the entire plant was offered to the city for, in yearly payments, recently, the sale for which was knocked out by the mayor's veto. The new owners will operate the plant.

New Holland, Pa.—Eli Martin, a resident of this borough, has made a proposition to the borough council for erecting an electric plant and lighting the streets, and the indications are that it will be accepted. An electric power plant has been installed in the New Holland Silk Mill.

Northport, Ore.—W. R Lee and some Montana capitalists have been granted a franchise to build and operate in Northport an electric light system. Work must be commenced before December 1.

Oconto, Wis.—By the burning of the planing mills of the Citizens' Electric Light & Fuel Company, the city is left in darkness as the electric lighting plant was located in the mills. The insurance was only $18,000 while the loss was $60,000.

Owenton, Ky.—J. M. Riley, of Bracken county, Ky., and W. E Arnold, of Dayton, O, have made arrangements to start a large flour mill, and probably an electric light plant, at this place. The business men of the town have donated a site.

Pasadena, Cal.—The city trustees of Pasadena are figuring on owning their own electric light plant, and for that purpose have called for bids on six different sets of specifications. All bids are to be in by January 1.

Pierre, S D.—The council has decided to put in an electric light plant for city service. Power for the operation of the plant will be supplied from the gas well.

Provo, Utah.—A committee of council reported in favor of the city erecting an electric light plant and also recommended the purchase of the electric plant of Reed Smoot, not including his dynamo. The report was accepted by the council and a power site on the Timpanogas canal will be purchased.

Royal Oak, Mich.—William Helzinger of this place made a proposition to furnish the village with a number of 1,500 candle power electric lights at 20 cents per night, and the council has accepted it and granted him a five years franchise.

Savannah, Ga.—The council has passed ordinances granting equal rights to construct overhead and underground lighting systems to the Brush and the Edison Electric Illuminating companies. The latter is a new company in Savannah while the Brush Company has had a monopoly of the lighting business here for some years. The officers of the Edison Company are: Geo. J. Baldwin of Savannah, president; M. P. Clough of Boston, vice-president; W. Cameron Forbes, of Boston, treasurer, and W. W. Mackall of Savannah, treasurer.

San Francisco, Cal.—Judge Seawell rendered a decision here on the 16th inst. which promises to make future contracts for the lighting of streets and buildings in this city a subject of public competition. The decision was in a suit brought by the Mutual Electric Company against Mayor Phelan and the Board of Supervisors. It holds in effect that as long as the San Francisco Gas & Electric Company is permitted to maintain posts and poles for the stringing of overhead wires it is the legal duty of the Supervisors to grant the plaintiff corporation a similar privilege.

MANUFACTURING, ETC.

Ft. Wayne, Ind.—The Fort Wayne Electric Corporation has just shipped a 1,000 light dynamo and equipment to Chelsea, Mich., and a 125 arc light machine to Lowell, Mass. It also dispatched a car loaded with dynamos and station material, lamps, etc., for a large plant it is installing at Natchez, Miss., and shipped a 2,000-light dynamo to Dublin, Ga.

Pittsburg, Pa.—The Westinghouse Company it is said has contracts on hand for 262 electric railway motors and 8 generators for English railways.

Sharon, Pa.—The Aschman Steel Casting Company has decided to expend $20,000 on improvements in its plant. Two new electric cranes are to be placed in the works.

Shanghai, China.—The municipal council, by resolution passed recently, invites tenders for a concession for constructing and working about 23 miles of electric tramways (trolley system) in the streets of Shanghai. Plans may be seen and particulars obtained upon application to Blackall & Baldwin, 39 Cortlandt street, New York, or to Charles Mayne, municipal engineer, Shanghai. Tenders for the concession must be sent not later than the 15th of March, 1899, to J. O. P. Bland, secretary to the municipal council, Shanghai.

Warren, O.—The Warren Electric & Specialty Company has arranged for a large addition to its plant which will necessitate the employment of 50 more people.

POWER AND TRANSMISSION PLANTS.

Chicago.—Armour & Co. will change the motive power at their packing houses from steam to electricity believing the latter will prove much more convenient and economical. Work will soon begin on the power-house, and already some of the engines and dynamos have been purchased. The lighting system is also to be changed and simplified for the sake of economy and better illumination. The works have already been wired for 5,000 lights. There will be one 5,000 and two 3,000 light alternators installed as soon as possible, and more may be purchased. A cross-compound Corliss engine of 1,700 horse power is ready for the completion of the power house, and two generators of 2,400 electrical horse power are also about ready. The "Inter-Ocean" states that men well posted in the affairs of the packing houses at the yards are of the opinion that the departure of this firm means a like move on the part of the other large concerns.

COMPANY MATTERS.

Boston, Mass.—The Plymouth & Sandwich Street Railway Company has filed a certificate that 50 per cent. of its capital stock has been paid in, the whole having been subscribed. H. B. Taylor is president; W. H. Brine, treasurer; W. H. Hawley, clerk.—The Webster & Dudley Street Railway Company has filed its certificate that its entire capital has been paid in. E. S. Hill is president; John Flint, treasurer; Charles Haggerty, clerk.

Norwalk, O.—The Citizens' Electric Light & Power Company of this city has increased its capital stock from $30,000 to $70,000.

PERSONAL AND MISCELLANEA.

William E. Hale, treasurer and one of the largest stockholders of the Toledo Traction Company, died at his home in Chicago on the 16th inst. He was 65 years old. Mr. Hale was elected treasurer of the Toledo Traction Company when that corporation, having absorbed the Robison interests, was reorganized.

Alexander McAdie, forecast officer in the Weather Signal Office in New Orleans, has received notice of his selection as one of the editors of "Terrestrial Magnetism and Atmospheric Electricity," an international quarterly journal published in Cincinnati, London and Berlin.

The First Regiment Volunteer Engineers, Colonel Eugene Griffin, arrived at New York from Porto Rico on Thursday last in better condition than any other regiment that has returned from the seat of war. The regiment has received a sixty days' furlough, at the termination of which they will be mustered out, having made a record that will long be remembered to their credit.

The Street Railway Employes' Association of New Orleans, as we learn from the "Picayune," is planning for an innovation in connection with the Carnival that promises to add a very interesting feature. It is intended to give a carnival parade of street cars. The various car barns are taking up the matter and a committee has been appointed from each of the seven stations. There will probably be two cars from each station and one gotten up by the traction management. These cars will each be lighted with about 1,000 lights, which will make a magnificent display, as the largest number ever put on a car in New Orleans is 350. The seats will be taken out of summer cars and they will be made into floats and masked men will be placed on them. The affair will take place on the Saturday before Mardi Gras.

The Philadelphia "Inquirer" states that James F. McLaughlin, an electrical and mechanical engineer of Philadelphia, is preparing for a trip to Cuba and Porto Rico in the interest of some Philadelphia and New York capitalists who are about starting enterprises in the newly acquired countries. One of the schemes, plans for which the Philadelphian is now working upon, is a 250 ton ice plant to be erected at Baracoa. There are, he says, a number of other projects on foot, but it will require personal observation in both the islands before they can be inaugurated. Mr. McLaughlin has been furnished with letters of introduction to the respective United States authorities in each of the countries by Secretary Alger and Secretary of the Navy Long. He will be gone at least three months, and it is possible that his absence may be prolonged to six months.

Mrs. Julia Davis has made application for the place of conductor on the Terre Haute Street Railway, and has been making a study of the duties required, spending all the extra money she could spare in taking rides over the line watching the operations of conductors and motormen. One of the conductors in speaking of the applicant to a reporter said: "Mrs. Davis has been on my car, I might say, a hundred times. Only Monday or Tuesday night she was on my car and kept me busy answering all kinds of questions. I understand that she is writing a book which will be called 'Dandy Dan, the Street Car Motorman,' and her trips over the line is to catch phrases to be used in the book. However, I have been told that she intended to make application for the position of conductor. I believe she would make a good one, as she now seems to understand the duties I think she would be able to keep a trolley on the wire and collect fares without making a mistake. Don't know how she would get along with some one who would refuse to pay his fare or insisted on getting change when he had not paid a cent. Guess the boys would all treat her right, and she might be a drawing card for the company for several weeks."

RECENT COMPANY ELECTIONS.

Globe Street Railway Company, Fall River, Mass.—Directors: Edward N. Gibbs and Charles L. Hubbard of Norwich, Conn; John N. Beckley and T. J. Nicholl of Rochester, N. Y; Benjamin Strong of New York; Marcus G. B. Swift, Frank W. Brightman, Robert S. Goff and Herbert H. Read of Fall River.

Park & Falls Street Railway Company, Youngstown, O. —President, S. C. Grier; vice-president, Joseph Hastings; secretary and treasurer, C. W. Dallinger, all of Pittsburg, Pa.; directors: the officers and T. H. McAfee and John Murphy of Pittsburg, and W. H. Park and H. G. Hamilton of Youngstown.

People's Electric Railway Company, Sandusky, O.—Directors: George H. DeWitt, George Feick, C. L. DeWitt, William H. Gilcher, Jacob Kuebler, Daniel Kunz, A. W. Proutt, Frank Stang, T. B. Taylor, John Geideman and Thomas Wood.

COMMERCIAL PARAGRAPHS.

The attention of manufacturers and exporters who receive orders from South America is called to the card of The London & River Plate Bank, Limited, for which Mr. Geo. O. Gordon, 70 Beaver street, New York, is agent in the United States.

This institution is considered one of the strongest and most prosperous foreign banking corporations of London. Its sphere of operations is confined to Brazil, the Argentine Republic and Uruguay, with the Government of each of which countries it has financial relations.

The subscribed capital and reserve fund together represent the equivalent of twelve and one-half millions of dollars. For the year ending on September 30, 1898, the shareholders received in dividends twenty per cent. on the paid up capital.

Branches of this Bank are established in the following ports and cities in South America: Para, Pernambuco, Rio de Janeiro, Montevideo, Paysandu, Buenos Aires, Rosario and Mendoza. In all other places of importance on the east coast of South America it is represented by agents.

The Electric Appliance Company's new catalogue of telephone apparatus and telephone construction material, No. 14, is being well received by the telephone trade, and, judging from the orders for telephone material that are being received, is being very extensively used. The Electric Appliance Company claim that they have the most complete catalogue of telephone supplies that has yet been issued and are pleased to supply copies free of charge to the telephone trade.

INVENTORS.—We neither purchase nor sell your patent, but we examine and report on it to you. If it has merit we furnish endorsements of experts that commend it to capitalists—and those who can use it. Correspondence solicited. Fees moderate. Address

EXPERT, care ELECTRICITY.

INCORPORATIONS

The Huntingburg Light & Power Company, Huntingburg, Ind. Capital stock, $4,500.

The Mutual Electric Company, Waco, Texas. Capital stock, $10,000. Incorporators: W. W. Seley, S. W. Slayden, I. A. Goldstein and L. Migel.

The East Chicago Light & Power Company, East Chicago, Ind. Capital stock, $1,500. Directors: George W. Watson, H. N. Haley and M. L. Pike.

The Charleston & Mattoon Electric Railroad Company, Charleston, Ill. Capital stock, $125,000. Incorporators: Forbes Helton, W. R. Williams and W. R. Patton.

The Kirlin-Gray Electric Company, Watertown, S. D. Capital stock, $50,000. Incorporators: William J. Gray, Minneapolis; George A. Gray, St. Paul, and O. M. and Samuel Kirlin, Watertown.

The Trans-Mississippi Electric Light & Power Company, Macon, Mo.—to establish and manage electric light and power stations. Capital stock, $30,000. Incorporators: Col. F. W. Blees, J. F. Schaefer and Charles E. Roel.

The Miller Improved Incandescent Lamp Company—to establish a plant in Arapahoe County, Col. Capital stock, $50,000. Incorporators: Andrew H. Miller, Merwin J. Barnes, Ernest H. Fontaine and Charles T. Linton. Incorporated at Denver.

The Wichita Railway & Illuminating Company, Wichita, Kan.—to equip and operate a street railway system and an electric lighting and power plant in Wichita. Capital stock, $500,000. Directors: Earnest Rambeck, E. L. Mattling, H. G. Landis, W. O. Church and George E. Spalton, all of Wichita.

The Valley Electric Light Company, Valley Falls, N. Y.—to manufacture and sell electricity for the purpose of lighting and heating public and private buildings in Lansingburg, Melrose, Schaghticoke, Stillwater, Valley Falls and Eagle Bridge. Capital stock, $10,000. Incorporators: E. O. Neil, H. Carpenter, Valley Falls, and J. W. Carpenter, Hoosick Falls.

The Fort George & Eleventh Avenue Railway Company of New York City (a consolidation of the North End Street Railway Company, the Fort George & Eleventh Avenue Railway Company and the Fort George Extension Railway Company). Capital stock, $3,000,000. Directors: John T. Little, Jr., Ambrose F. McCabe, Fred C. Garrick, Frank F. Ogston and Sharon Graham of New York, Clement McCumming of Yonkers, Charles A. Gilbert of White Plains, William A. Dibbs of Brooklyn, and D. C. Moorhead of Jamaica, N. Y.

ELECTRICAL PATENT RECORD.

Letters Patent Issued November 22, 1898

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

614,575. Conduit and Electric-Current Conductor for Surface Railways. Arthur Petzenburger, Gross Lichterfelde, Germany. Filed March 30, 1896.
614,709. Means for Driving Railway, Tramway or Automobile Cars. Gustave Dupont and Maxime Johannet, Paris, France. Filed Oct. 29, 1896.
614,651. Car-Fender. John D. Hodges, Chicago, Ill., assignor of five-sixths to James Bellew, Frank H. Repetto and Patrick J. King, same place. Filed Feb. 8, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

614,484. Hanger for Electric Lamps. Junius E. Mayo, Belvidere, Ill. Filed June 1, 1898.
614,528. Electric-Lighting Gas-Burner. John M. Anck, Philadelphia, Pa. Filed Oct. 19, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

614,462. Commutator. John R. Grindrod, Lynn, Mass., assignor to the General Electric Company of New York. Filed Feb. 6, 1897.
614,472. Potential-Switch. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Brothers & Company, New York City. Filed Aug. 5, 1897.
614,571. Transformer System and Apparatus. Adolph Muller, Hagen, Germany. Filed July 30, 1897.
614,608. Dynamo-Electric Machine or Electromotor. Eugene Cantono, Pavie, Italy. Filed Dec. 16, 1897.
614,685. Magnetic Cut-Out. Leonard Andrews, Hastings, England. Filed Nov. 29, 1897.
614,794. Circuit Breaker. William I. Crawford, St. Louis, Mo., assignor of one-half to Abraham Cook, same place. Filed Aug. 23, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

614,677. Switchboard Apparatus, Signal and Circuit. Thomas C. Wales, Jr., Boston, and Frederick L. Rhodes, Winchester, Mass., assignors to the American Bell Telephone Company, Boston, Mass. Filed Nov. 26, 1897.

BATTERIES.

614,539. Secondary Battery. Nathan H. Edgerton, Philadelphia, Pa. Filed Sept. 14, 1897.
614,759. Galvanic Battery. Charles T. Richmond, Cleveland, O., assignor to the National Carbon Company, same place. Filed July 18, 1898.

MISCELLANEOUS.

614,453. Method of Manufacturing Electric Cables. Sebastian Z. de Ferranti, Hollinwood, England. Filed Dec. 28, 1897.
614,474. Transformer Stamping. Dugald C. Jackson, Madison, Wis., and William B. Jackson, Grand Rapids, Mich., assignors of one-half to William D. Packard and James W. Packard, Warren, Ohio. Filed Sept. 27, 1897.
614,572. Method of and Apparatus for Treating Ores. Joseph G. McNutty, New York City. Filed May 7, 1898.
614,597. Means for Conveying Cables, Wires or the Like Through Underground Conduits. John Wrigley, Elmira, N. Y. Filed June 14, 1898.
614,633. Electrolytic Apparatus. Friedrich A. Thum, Newark, N. J. Filed Feb. 8, 1898.
614,725. Apparatus for Constructing Insulating-Blocks. Johann Jungbluth, Cologne, Germany. Filed Jan. 18, 1898.

TELEPHONE AND TELEGRAPH.

Improvement in Telephone Apparatus.

During the past year or two great improvements have been made in apparatus for central telephone exchange offices. The Newark Telephone Company of Newark, N. J., has just installed a new central office equipment that is pronounced by experts to possess novel and astonishing features never before introduced in central exchange offices. It does its work so rapidly that a great deal of time and money is saved, requiring fewer operators and at the same time giving better service. The Newark Telephone Company is an opposition company to the Bell, and we are informed that such is the success of this exchange equipment that the officials of the Bell Company are simply amazed. This exchange is connected directly with 2,100 local subscribers, and also has connections with substations, giving it a total of over 3,100 connections. As the rentals charged by the Newark Telephone Company are much less than those charged by the Bell people, the citizens of Newark are to be congratulated on securing cheaper and more satisfactory service.

The Northern Minnesota Telephone Company, recently organized at Park Rapids, Minn., has completed its lines which connect Park Rapids with Menahga, Latona and Hubbard, and the system is in operation. The company expects in the near future to extend its lines to Badoura, Pine Point and other points in that section. It will also connect with Wadena, where an exchange system will be put in. It is the intention to eventually connect with other systems which connect with St. Paul, Minneapolis and other important points in the State. The head office of the company will be at Park Rapids. The present officers of the company are: A. B. Kerlin, of Freeport, Ill., president; Cyrus Hollinger, of Lancaster, Pa., vice-president; C. F. Moody, of Park Rapids, secretary and treasurer.

The annual meeting of the stockholders of the American District Telegraph Company, Brooklyn, N. Y., was held on the 21st inst. The old officers were elected as follows: Tunis J. Powell, president; David Barnett, vice-president; Henry W. Kilbourne, secretary and treasurer. The directors are Felix Campbell, Tunis J. Powell, M. N. Packard, William B. Davenport, William M. Van Anden, David Barnett, Clement Lockitt, James W. Ridgway, John A. Nexsen, Stephen Valentine, C.S. Dunning, Thos. Clark, Jr., James F. Pierce.

The Boston *News Bureau* states that the Erie Telephone Company, which recently gained control of the Union Telephone Company in Minnesota and all the independent lines in the Western Electric Telephone Company's system, now proposes to reorganize the companies composing the system by combining them all into one company with a capital of $500,000. The Boston paper says that companies owning nearly 4,000 miles of toll lines have virtually consented to come into the company. These companies all use the Bell instruments and have contracts with the Northwestern Exchange Telephone Company (Erie) and the Iowa Telephone Company.

The Central Commercial Telephone Company, recently organized in Pennsylvania, will open an exchange in Bellefonte in a few days. The company proposes to reach every town in Center, Clinton, Union, Clearfield and parts of Blair and Huntingdon counties. Subscribers can talk to any place in these six counties and Lycoming without extra charge. The rates to be charged will be $1.50 and $2 per month less than those charged by the Bell company. A lively competition is expected.

E. C. Spalding, temporary receiver of the Augusta Telephone & Electric Company, visited the exchange of the company in Augusta a few days ago in company with W. Robinson, who represents the New York creditors, for the purpose of investigating the situation. They found a number of applications for telephones which the management had not been able to put in. The company's directory of subscribers contains this inscription on the back:

"Our automatic switches
"Have no beaux,
"They don't chew gum,
"Giggle,
"Get saucy,
"Tired or sleepy,
"And they are not at all interested in your affairs."

At a meeting of the North & West Branch Telephone Company at Shamokin, Pa., on the 22d inst., it was decided to construct the proposed line between Williamsport, Montoursville and Montgomery to connect with the Shamokin Valley Company's line. The contract was awarded to W. D. Bearnard, of the East Telephone Construction Company, and work will be commenced within thirty days. It will cost about $100,000.

Long Distance Telephone Extension.

President Glidden of the Erie Telegraph & Telephone Company was at Galveston, Texas, on the 15th inst., when word came to him that the gap between Pine Bluff and Helena, Ark., was completed. "This," he said to a reporter of the Galveston *News*, "gives us a continuous telephone circuit extending from Galveston to Bar Harbor, Me., 2,600 miles. It is the longest in the world. Several talks were had to-day with northern points, but the line will not be opened for business until some time in December, as several important electrical transpositions must be made, together with the transferring of way stations, that a through circuit may be established. The circuit consists of a No. 8 copper metallic and runs via Dallas, Paris, Texarkana, Pine Bluff and Helena, where it is cabled across the Mississippi river to Lula, thence on to Memphis. At Memphis connection is made with St. Louis, Chicago, Omaha and all long distance points in the United States. The most northern point is Grafton, N. D.; western point, Omaha, and eastern point, Bar Harbor, Me. There will be no difficulty in talking with New York, Boston and other points as soon as the electrical conditions are perfected.

"It was about twenty-two years ago," continued Mr. Glidden thoughtfully, that Prof. Graham Bell communicated with me by telegraph, asking if a wire of our company could be used for an experimental test of the telephone between Boston and Manchester, a distance of fifty-eight miles. I was then manager of the Atlantic and Pacific Telegraph Company at Manchester, N. H. The test was arranged and it was a success, but we telegraphers were so skeptical regarding the workings of the telephone that for a moment we, unknown to the professor, broke the circuit, and of course the 'sound' ceased. After restoring it, the sound resumed, but even then little did we think that in twenty years we would be able to talk over the wire across the country and from Galveston to New York."

The municipal council of Shanghai, China, invites tenders for a concession for a period of thirty years for the exclusive right of establishing and working a telephone system in Shanghai. Plans may be seen and particulars obtained upon application to Blackall & Baldwin, 39 Cortlandt street, New York, or to Charles Mayne, municipal engineer, Shanghai. Tenders must be sent in not later than the 31st of March, 1899, to J. P. O. Bland, secretary of the council, Shanghai.

The Denver (Col.) *Republican* states that a new telegraph line is to connect Fort Grant and Carlos via Dunlap, Deer Creek, Davis, Lynch and Eureka. The route of the projected line crosses the Graham mountains, a distance of 50 miles. It is to take the place of the old military telegraph which ran through a sandy valley between Fort Grant and Carlos, requiring constant repairing.

John O. Barclay, formerly of Greensburg, Pa., has been appointed electrician of the Western division of the Western Union Telegraph Company, succeeding Charles H. Summers, deceased.

Messrs. Fuller & Perkins of Grand Rapids, Mich., are organizing a stock company to establish a complete telephone exchange to cover Mason, Oceana and Manistee counties, Mich.

The Home Telephone Company of New Albany, Ind., is arranging to have a connection with a telephone line to Indianapolis and intermediate points.

The Western Telephone Construction Company of Chicago has certified to a decrease in the number of directors from seven to five.

The Queen City Telephone Company has been organized at Charlotte, N. C., with J. A. Helvin as president and A. G. Brenizer as treasurer.

Henry Biederman, who recently obtained a telephone franchise at Paducah, Ky., is organizing a company to install a system.

New Companies Incorporated.

The Williams County Toll Line Company, Bryan, O.—to operate a telephone line. Capital stock, $30,000.

The Citizens' Telephone Company, Spencer, Ia. Capital stock, $10,000. Incorporators and directors: O. E. Sully, William Flindt, Ackley Hubbard, C. J. Mikish and J. F. Green.

The Northern Minnesota Telephone Company, Park Rapids, Minn.—to construct a line between Park Rapids and Waldena and in other parts of the State. Incorporators: Charles F. Moods, F. A. Vanderpool, Henry F. Witter of Park Rapids, A. B. Kerlin of Freeport, Ill., and Cyrus Hollinger of Lancaster, Pa.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N Y.—Nov 28:						
Albany Ry. Co	100	2,000,000	$1,750,000	1½ % Q., Aug. '98.	151	158
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug., 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Nov 28:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	.....	..	15
Bridgeport, Conn—Nov 28:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Nov 28:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98	73	..
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	26¼	27
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	...	..
Boston, Mass.—Nov 28:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97	13¼	13¾
North Shore Traction Co....com.	100	4,000,000	4,000,000	....	11	12
North Shore Traction Co....pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	76	80
b West End Street Ry. Co....com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	...	89½
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	110	110⅝
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	77½	77¾
Brooklyn N. Y.—Nov 28:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	215	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	67⅛	68⅜
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR....guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	231	240
eBrooklyn, Queens Co. & Sub. RR.	...	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	..	275
Kings County Elevated	...	4,750,000	4,750,000	....	2¾	4
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	..	..
Nassau Electric Railroad ....pfd.	...	6,000,000	6,000,000	....	70	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	...	1,000,000	1,000,000	....	..	..
Buffalo. N. Y.—Nov 28.						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	62	66
*Buffalo Railway Co	100	6,000,000	5,370,500	1 % Q. Dec., '97.	77	78½
Columbus O.—Nov 28.						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Aug., '98	58	60
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Nov 28:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '98	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Nov 28:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q.	290	298
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	13	..
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	8
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Oct. 98.	28¾	30
hNorth Chicago City RR	100	500,000	249,300	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Nov. 98	100¼	101
jChicago West Div. Ry....guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry....guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Nov 28:						
Cincinnati Inc. Plane Ry....com.	50	1,000,000	575,000	....	..	20
Cincinnati Inc. Plane Ry....pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	75
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	29¼	30
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118½	118¾
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1½ % Q.,Jan., 98.	..	..
Cleveland, Ohio.—Nov 28:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¼ % Jan., '98	39	41
Cleveland City Ry	100	8,000,000	7,600,000	¼ %., Oct., '98.	70	74
Cleveland Electric Ry	100	12,000,000	12,000,000	¼ % Q., Oct., '98	78½	79½
Detroit, Mich.—Nov 28:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Nov 28:						
City Railway Co ....com.	100	1,500,000	1,470,600	1¼ % Q., Jan.1,'98.	105	..
City Railway Co ....pfd.	100	600,000	600,000	1½ % Q.,Jan. 1,'98	155	156
People's Street Railway	....	1,100,000	....	....	102	103

* Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Nov 28:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	–
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	–
Holyoke Mass.—Nov 28						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	185	200
Hoboken, N. J.—Nov 28:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	100	–
Indianapolis, Ind—Nov 28.						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	24	25
Lancaster, Pa.—Nov 28.						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	–
Lancaster & Col. Electric Ry	....	....	87,500	....	..	–
West End Street Railway	...	....	....	....	..	–
Louisville, Ky.—Nov 28:						
Louisville Ry....com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	85	40
Louisville Ry....pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	101	108
Minneapolis, Minn.—Nov 28.						
Twin City Rapid Transit....com.	100	17,000,000	15,010,000	....	27	29
Twin City Rapid Transit....7 % pfd.	...	8,000,000	1,714,200	1¾ %. Jan., '98.	101	108
Montreal, Canada.—Nov 28:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	276⅞	277
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	105	10[illegible]⅙
Memphis, Tenn.—Nov 28:						
Memphis Street Railway Co	100	500,000	500,000	....	15	–
New Haven, Conn.—Nov 28:						
Fair Haven & Westville RR	25	1,500,000	900,000	3 % S., Sept. '98.	62	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	40	..
New Orleans, La.—Nov 28:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	151	200
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	120	125
New Orleans Traction Co....com.	100	5,000,000	5,000,000	....	1½	8½
New Orleans Traction Co....pfd.	100	2,500,000	2,500,000	....	8	11
aCrescent City RR....guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	16¼	32
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	81	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	23½	25
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	51⅞	52¼
New York—Nov 28						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98	180	198
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98	179¾	180
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	32	87
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	216½	225
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	180	183
hEighth Avenue RR	100	1,000,000	1,000,000	....	348	355
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	370
jNinth Avenue RR.......guar.	100	800,000	800,000	....	160	180
kSixth Avenue RR.......guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	385	420
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98	178	1[illegible]0
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. '98.	159	161
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	72	78
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Nov 28						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	51	51½
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Nov 28:						
Allegheny Traction Co	50	500,000	500,000	....	50	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	2[illegible]¾	2[illegible]⅝
Consolidated Traction Co....pfd.	50	15,000,000	15,000,000	3 %. May, '97	65⅝	65½
pCentral Traction Co	50	1,500,000	‖900,000	1½ %. Nov. 7, '98.		...
qCitizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
rDuquesne Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	8½ %, Nov. 7, '98	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	25	..
Pgh., Allegheny & Man. Trac. Co.	50	8,000,000	‖2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	8,000,000	8,000,000	½ %, Jan., '96.	25	28⅜
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	.
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

* Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October,

s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Nov 28						
Union Street Railway Co	100	$350,000	$350,000	2 %, Feb. '98.	...	150
Northampton, Mass—Nov 28:						
Northampton Street Ry	100	300,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Nov 28.						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Nov 28:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Nov 28:						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	68	71
Philadelphia.—Nov 28.						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14⅛	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	40	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	583,900	‡583,900	3 % S—July, '98.	67	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	66	..
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450	....	28⅞	28¾
bElectric Traction Co	50	....	8,297,920	....	..	...
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	320	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	400	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	89	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	265	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	184½	186
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	135	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh., Oct. 98.	93⅞	93¾
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	170	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	285	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	2,0	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	220	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	225	250
Rochester, N. Y.—Nov 28:						
Rochester Railway Co	100	5,000,000	5,000,000	....	10	12
Reading, Pa.—Nov 28.						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
kCity Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Nov 28:						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct., '98.	151	155
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '98.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % Oct., '98.	178	180
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry.......com.	50	500,000	500,000	....	54	60
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	120	122
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	58	60
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Nov.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	108	109
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	53¾	54
Presidio & Ferries RR	100	1,000,000	550,000	....	8½	..
Scranton, Pa—Nov 28:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Nov 28:						
Springfield Consolidated Ry	100	750,000	750,000	....	....	..
Springfield O.—Nov 28:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	..
Springfield, Mass.—Nov 28:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	200	205
Toronto Canada.—Nov 28:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	105	105⅛
Montreal Street Railway Co	..	4,000,000	4,000,000	4 % S.	276½	277
Washington, D. C.—Nov 28						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	79¾	79⅞
Columbia Ry. Co	50	400,000	400,000	6 % A.	65	70
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	17	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	..	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	128½	130
Worcester, Mass.—Nov 28:						
*Worcester Traction Co.......com.	100	3,000,000	3,000,000	....	12	14
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	98	100
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Nov 28:						
Wilkesbarre & Wyoming Val. Trac	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
f Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
ij Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a. in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Nov 28						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., Oct., '98.	280	282
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '93.	75¼	76
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '93.	138	138½
New York.—Nov 28:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	95	96½
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	107	109
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	175	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	75¼	76
*Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	..
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	109	..
Mexican Telephone Co	100	2,000,000	......		..	.80
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	1½ % Q., Oct., '98.	141	145
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	92	..
†Commercial Union Telegraph Co	25	500,000	500,000	8 % S., July, '98.	110	113
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	93¾	94
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Nov 28:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	173	174
Chesapeake & Potomac Telep. Co	100	......	......	....	51	...
Chicago Telephone Co	100	......	......	......	2.0	..
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	182½	134
Empire & Bay States Telegraph Co.	...	......	......	....	75	76
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	77	..
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	112	113
Providence (R. I.) Teleph. Co	50	....	......	....	89½	
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Nov 28:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new]...... "	100	18,276,000	18,276,000	......	82½	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2¾	3¼
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	39	..
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., Oct., '98.	59	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Nov 28:						
Edison Elec. Ill'g Co., New York	100	9,188,000	7,988,000	....	151¼	..
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	4,000,000	1½ % Oct., '98.	..	..
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	28	30
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug , 1898.	..	...
General Electric Co. [new].... "	100	18,276,000	18 276,000	......	82⅜	82½
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.—Nov 28:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	165	175
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Nov 28:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	50⅝	50⅞
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	51⅜	51⅝
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co	10	6,500,000	550,000	$82500 dis. Jan. '97	13¾	14
Southern Elec. Light & Power Co	10	187,500	187,500	....	16	..
Miscellaneous.—Nov 28:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	40	..
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	13
Eddy Electric Mfg. Co	25	......	......	....	....	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	125	..
Hartford (Conn.) Lt. & Power Co	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	177	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	84	..
Rhode Island Elec. Protec. Co	100	......	......		118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q	157½	160
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	187⅞	188¼
Thomson-Houston Welding Co	100	......	......	8 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	. ....	......	....	100	..

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200 of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Nov 28:						
American Electric Heating Co	50	10,000,000	....	...	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh. Nov.16, '98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	92	100
New York.—Nov 28:						
Consolidated Electric Storage Co	...	......	....	....	9¼	16
Edison European	...	......	....	....	..	..
Safety Car Heating & Lighting Co	100	......	....	....	108	104
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	36	40
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	99	100
Philadelphia, Pa.—Nov 28:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co.	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	..	..
Welsbach Commercial Co......com.	100	3,500,000	......	....	..	10
Welsbach Commercial Co.......pfd.	100	500,000	......	2 % Q	50	51
Welsbach Light Co	5	525,100	......	....	35¾	33¾
Welsbach Light Co., Canada.	5	500,000	......	....	..	2¼
Pittsburg, Pa.—Nov 28:						
Carborundum Mfg. Co	100	200,000	200,000		..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	117	..
Miscellaneous.—Nov 28:						
*Barney & Smith Car Co........com.	100	......	1,000,000	....	13	16
*Barney & Smith Car Co.........pfd.	100	......	2,500,000	2 %	55	60
Billings & Spencer Co	25	......	....	....	80	86
Consol. Car Heating Co	100	1,250,000	1,250,000	1¼ % Feb. '98.	35	36
Johns-Pratt Co	100	......	....	....	90	100
*Pratt & Whitney Co............com.	100	......	....	....	4½	8
*Pratt & Whitney Co.............pfd	100	......	....	....	45	50
Stillwell-Bierce Co.............com.	..	......	....	....	30	..
Stillwell-Bierce Co.............pfd.	..	......	....	2 % Sept. 1, '98.	95	98
Shults Belting Co	100	500,000	....	....	82	87
St. Charles Car Co	...	......	....	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Nov 28, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry.......1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*114	114⅛
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*114	114½
‡Watervleit Turnpike & RR.1st mtg. 6s	850,000	850,000	1919	M. & N.	*120	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*116	....
Troy City Railway Co.......1st 5s	....	....	......	......	*106½	......

‡Interest guar. by Albany Ry. Co
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Nov 28, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	115⅛	117
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	115½	116
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103	104
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	116	117
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	102	103
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co.........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	604,000	580,000	1932	M. & N.	117	119
City & Suburban Ry......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	115	115¾
Lake Roland Elev.,..........1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113⅛
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	119¼	120

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	103	105
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105¼
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	109	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation - Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	..
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry...........1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102	102¼
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T...........4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	105½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	62½	......
North Chicago St. RR........1st mtg. 5s,	3,171,000	3,171,000	1906	J. & J.	104¼	104½
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	...	......
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	101½	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	106½	107
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	107¼	......
West Chicago St. RR........Deben. 6s...	2,700,000	700,000	1911	J. & D.	101	......
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	95	......
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Nov 28, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	105¾	106
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	108	109
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	....
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	108	......
So. Cov. & Cin. St. Ry........1st mtg. 6s.	250,000	250,000	1912	M. & S.	......	118⅛
‖So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	....	135

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Nov 28 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	105⅛	106
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	105¾	106
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	102	103
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	105	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
aEast Cleveland RR.........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	102½	103½
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	97½	98½
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	....
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	.....	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	108	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	107	....
Winchester Avenue RR....1st mtg. g. 5s,	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 5	100,000	94,00[illegible]	1909	M. & S.	103	......

New Orleans La.

Date of Quotation—Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	102	....
Crescent City RR............1st mtg. 6s.	......	50,000	1899	M. & N.	101	83⅛
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83	. ...
New Orleans City RR........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	104½
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	104	....
N. Orleans & Carrollton RR.2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	......	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	......	...
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	105	......

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn).1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	110	111
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122⅝	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	114
Broadway Surface............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface...........2d mtg. 5s.	1,000,000	1,000,000	1905	......	104	105½
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	117
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	93
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	110	112
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	104½	105
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	106	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	101	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111	113
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	120
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	116	116⅛
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	102
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115	117
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	97	99
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	122¾	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	118	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	116	117
Second Avenue Ry...............Deb. 5s.	300,000	300,000	1909	J. & J.	109	110
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	113⅛	115
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	125	......
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	112½	115
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112⅛

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry....................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Nov 28, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry...........1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry...................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry..................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry...................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	105⅛	105¾
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,800,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...............Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Nov 28 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	......	......
Central Traction Co...............1st mtg. 5s.	875,000	875,000	1930	J. & J	108⅛	109⅛
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	115	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	......	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	108	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	106¼	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	...	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	112	......
Second Ave. Traction Co....................5s.	2,500,000	2,000,000	1934	J. & D.	....	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,247,000	1933	M. & S.	108⅛	109⅛

St. Louis.

Date of Quotation—Nov 28, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co............1st mtg. 6s	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	[illegible]	1,000,000	1913	J. & J	111⅛	112⅛

' With interest. Unlisted. *With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Nov 28, 1898						
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	108
Lindell Ry. Co......................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co..........................	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co..............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	108
People's RR. Co....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co...............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry...............Income 5s.	800,000	800,000	......	....	65	70
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1913	J. & J.	112	113
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	8,500,000	1,737,000	1918	J. & J.	114½	115½
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Nov, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	115½	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	114½	......
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	....	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1913	J. & J.	128½	129
†Metropolitan Ry. Co................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co..............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126	......
†Park & Cliff House RR.......1st mtg. 6s.	850,000	350,000	1912	J. & J.	106½	108½
†Park & Ocean RR................1st mtg. 6s.	250,000	250 000	1914	J. & J.	112	......
†Powell St. Ry.......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	123
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Nov 28, 1898.						
Belt Ry. Co.......................Cons mtg 5s.	500,000	450,000	1920	J. & J.	51	....
Columbia Ry.......................1st mtg. 6s.	500,000	500,000	1914	A. & O.	118	125
Eckington & Soldiers' Home mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	128	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Nov 28. 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	102½	......
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	112½	114
†Citizens' St. R. (Ind'polis).1st cons. m. 5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	3,000,000	2,366,000	1932	M. & N.	110¾	111
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	108	105
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	109⅛	109⅜
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	102	102½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	116	117
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	100½	101½
††No. Hudson Co. Ry. (N. J.).Cons. mtg. 5s	8,000,000	2,378,000	1928	J. & J.	104	......
No. Hudson Co. Ry. (N. J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry...........1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	95	100
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	......	......	......
St. Paul City Ry.......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	......	....
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Nov 28, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	.
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	109	110
Pittsburg, Pa						
Date of Quotation—Nov 28, 1898						
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Nov 28, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,812,000	1910	......	110⅛	115
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1933	......	110¼	....
Edison Elec. Illg. Co. (Brooklyn)........	2,500,000	1,500,000	1940	....	110	115
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)................	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Nov 28. 1898.						
American Bell Telephone....................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co..............7s.	....	......	......	......	....	......
N. Y. & N. J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Nov 28, 1898.						
American Electric Heating............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co....................	....	....	......	......	......	25
Barney & Smith Car Co....................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co.....................6s.	....	....	1904	M. & S.		....
Worthington Pump Co..........	75.000	......	......	......	......	....

*Unlisted Nominal

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12⅝@12¾c.; Lake, 13c.; casting, 12⅝@12¾c.

The South Side Street Railway, Chicago, is about to substitute electricity for cable power on its lines.

The Electric Storage Battery Company of Philadelphia has brought a suit in the United States Circuit Court at Boston against the Hatch Storage Battery Company to restrain the defendants from infringing on patents owned by the plaintiff.

The Edison Electric Illuminating Company of New York reports for October: Gross earnings, $253,897, increase over the same month in 1897, $39,317; operating expenses and taxes, $135,589, increase $24,407; net earnings, $118,308, increase $14,-909; surplus, $73,733, increase $9,409.

The Keely Motor Company directors held a brief session after attending the funeral of the inventor in Philadelphia on the 23d inst., adopted resolutions expressing faith in the ultimate success of Keely's alleged discovery, and suggesting that Thomas A. Edison, the electrical inventor, be invited to assist in completing the work.

The annual report of the Boston Elevated Railway Company, which covers the operations of the West End Street Railway Company, shows that for the year ending September 30 the company earned enough to pay all charges, including dividends on the West End Street Railway and 2½ per cent. on $5,000,000 Elevated stock, and leave a balance of $214,077.

A committee consisting of George W. Young, Walter G. Oakman, James Timpson and Edward C. Jones has prepared a plan for the reorganization of the Elmira Municipal Improvement Company, owner of the Elmira & Horseheads Railway, gas, electric light and waterworks at Elmira, N. Y. Copies may be obtained from the depositary, the United States Mortgage & Trust Company, 59 Cedar street, New York.

A contract for the construction of 150 new open cars has been made by the Brooklyn Heights Railroad Company with the St. Louis Car Company. The cars will be the large sized variety introduced on the lines last year and will be 36 feet long, with 13 reversible benches and with a seating capacity of 75. The cars will be delivered next spring and all the down town lines will be equipped with them. All the old style cars will be taken off and either sold or destroyed.

The consolidation of the leading electric companies of Baltimore, Md., is rapidly being pushed to completion. It is announced that in a short time the new company will place on the market $4,000,000 five per cent. bonds, which will, it is understood, be offered at 102½ and interest. The $5,000,000 of stock will be listed on the Philadelphia Stock Exchange. The name of the new company has not been finally determined upon, but the "Baltimore Consolidated Electric Company" is proposed.

At the meeting of the stockholders of the Southern Electric Light & Power Company in Philadelphia on the 23d inst., the proposition of the directors to increase the capital stock of the company from $400,000 to $2,000,000 was ratified by a vote of 31,851 shares out of a total of 40,000. The Southern Electric Light & Power Company supplies all that portion of the city lying below South street from river to river, and the increase in capital was prompted by the additional plant and machinery necessary to fully supply the district covered by the company.

The Illinois State Railroad Commissioners in their annual report petition for special legislation which shall give them jurisdiction over all the street railroads, the sleeping car companies and telephone and telegraph companies operated in the State. The report also recommends that the Railroad Commissioners be given the discretionary power to pass upon the advisability of the construction of any new road, thereby preventing the speculator from playing upon the credulity of the public by placing upon the market bonds issued for the construction of a road which can never even pay its operating expenses.

Attorneys Watson and McCleave have filed in Common Pleas Court No. 3 at Pittsburg, Pa., proofs of service upon Murray A. Verner, H. Sellers McKee, Daniel Beech and D. J. Brickell of the bill in equity filed recently by the Pittsburg & Birmingham Traction Company to obtain an accounting of over $1,700,000. It is claimed that the company was defrauded of most of that sum. The court made an order giving each defendant twenty days after serving of notice of the filing of the bill to enter his appearance and file an answer. It was also directed that bill be served on Edward W. Clark, S. W. Colton, Jr., Edward W. Clark, Jr., J. Milton Colton, C. Howard Clark and C. Ford Stevens, wherever the persons named can be found.

General McNulta, receiver of the National Bank of Illinois and of the Calumet Electric Railway Company, has filed a report in the United States Circuit Court, Chicago, giving an itemized statement of the receipts and disbursements of the Calumet Railway Company between May 1, 1897, and August 31, 1898. The total receipts were $503,475, and the disbursements were $492,938 86. The receipts from operation sources were $281,786 39. The cost of operation and expenses were $297,-469. On the credit side was included an item of $195,000, representing the receiver's certificates issued by order of the court. The certificates were issued in order that the National Bank of Illinois might be reimbursed for money which it advanced to the railway company. These certificates bear 6 per cent. interest yearly and are payable on or before June 1, 1900.

James F. Rusling and a number of other holders of preferred stock in the Trenton (N. J.) Light & Power Company, which was recently sold to a syndicate headed by Colonel Kuser, have instructed Counsellors Beasley and Holt to institute suit against James Moses to compel him to pay over to the preferred stockholders of the company the sum of $100,000, the amount received by Mr. Moses for the 2,500 shares of common stock of the company which he sold to the syndicate. Mr. Rusling and some of the other holders of preferred stock claim that this stock was held in trust for them, while Mr. Moses and several of the stockholders contend that it was the personal property of Mr. Moses, awarded to him by the stockholders of the People's Electric Light Company for managing the deal by which that company was merged in the Trenton Light & Power Company.

Five hundred thousand dollars of the Westinghouse Electric & Manufacturing Company's new issue of $3,500,000 of 5 % gold coupon debentures were offered for sale last week by a Pittsburg bank at 102½ and interest. The following facts regarding the loan are given in the "Financial Chronicle": "Fifteen-year 5 per cent. gold coupon debentures, free of tax, issued by the Mercantile Trust Company of New York against the bond of the Westinghouse Electric & Manufacturing Company; total issue $3,500,000; denomination $1,000; interest payable January and July. Secured by total assets of the company, which on September 30, 1898, exclusive of patents, charters, franchises, good will, etc., aggregated $16,045,593. The debenture contract provides by ample agreement, and by proper instrument on record in the Recorder's office, that there shall be no lien placed on the company's present or future real estate or other assets that does not provide for these debentures. Commencing 1900, the company shall pay to the trustee, either in cash or by surrender of debentures, $150,000 yearly. For the purpose of the sinking fund, the company may draw debentures by lot, and the debentures so drawn shall be paid for at $1,050 each, with accrued interest."

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CONTENTS.

EDITORIAL NOTES.

The Telephone and Lighting Situation. It would certainly seem as though the near future would see some important developments in the telephone and electric lighting fields in New York City. But a short time ago everything pointed to a change in the control of the Consolidated Telegraph & Electrical Subway Company and of the Empire City Subway Company, which have for years been operated in common, the former leasing the latter. It is said to be the intention of the Consolidated Telegraph & Electrical Subway Company to retain control of the high tension conduits, while the Empire Company, which has been all along practically controlled by the New York Telephone Company, will continue to operate the low tension conduits. The separation of these two companies and the change in their control, following as it does the incorporation of the New York Gas & Electric Light, Heat & Power Company with its capital of $25,000,000, as well as the rumor that the Metropolitan Street Railway Company contemplates going into the electric lighting business, appears significant, to say the least, and leaves the question as to who the new owners of the subway companies will be in doubt. Possibly what is known as the People's Telephone Company, which was not long ago incorporated at Albany with a capital of $5,000,000, with the intention of fighting the existing company, and which is said to have the good-will of the present city administration, will have a hand in the matter. It is moreover thought that the two subway companies are still controlled by men influential in politics, but whose names will not be allowed to appear in connection with the management.

Another point worthy to be mentioned in this connection is the fact that another new telephone company was incorporated in Albany on November 24, which, from the ingenious manner in which the incorporation papers were drawn, has led many to believe that the undertaking will be a far more important one than would appear at first glance. Although the title filed is "The New Rochelle & Westchester Telephone Company," provision is made for covering the whole of New York, as well as several other States. One of the incorporators of the new undertaking is reported as having made the following statement as to the aims of the company:

"For the present the business of the company will be confined to a system between New Rochelle and Mamaroneck. In time we will put in exchanges and connect other cities, as provided for in our charter. We will not have any exchanges in New York City for the present, but we may later."

What with the secrecy which surrounds the plans of the several new lighting and telephone companies, and the manipulation of the existing subway properties, it will be surprising if the coming year does not bring forth some rather startling developments in those industries.

* * *

Expense Account of the Shoreditch Destructor Plant. Just at present what is known as the Shoreditch garbage destructor plant, situated in a vestry of London, appears to be attracting wide attention in England. As we have several times explained, a number of these plants were erected a year or two ago in various localities throughout Great Britain with a view to consuming the garbage collected in the vicinity, the steam obtained from this low grade fuel being utilized principally for generating electricity for lighting purposes. From a hygienic point of view the destruction by fire of the garbage of a community was highly to be recommended and was much preferable to placing it upon barges with a view to dumping it either at sea or upon barren ground as was formerly done with the refuse from the vestry of Shoreditch. As to whether any financial profit could be derived from a lighting plant run with refuse as a fuel is a question which has excited considerable interest during the past year, not only in Great Britain but in this country as well, for should the experiment prove successful on the other side of the Atlantic there is scarcely any doubt that destructor plants of this or a similar nature would be erected in many of the principal cities in the United States where the problem of garbage disposal has been worrying the authorities for years. On November 15 a report embodying a trading account of the Shoreditch destructor plant for its first year of operation was made public, and it is the figures given in this statement that are attracting so much attention.

Before giving these figures it might be well for our readers to get an idea of just what these plants consist. There is a destructor house, which usually contains a number of cells or small furnaces into which the refuse is dumped. A forced draft is generally employed to stimulate combustion, the obnoxious gases passing out of the front of each cell and through the boilers before effecting their escape to the atmosphere. As previously stated, the steam produced by this low-grade fuel is in most cases used to generate electricity for lighting purposes. Several serious difficulties had to be overcome in designing plants of this nature. In the first place the steady feeding of the refuse would generate a steady

amount of steam, whereas the demand for power would naturally be irregular, a far greater amount being required at night than during the day. Two methods of overcoming this difficulty were employed: storage batteries were made use of for storing the surplus current, and what is known as the Halpin thermal storage system was installed. Both of these systems are in use in the Shoreditch plant.

At Shoreditch a destructor cell is placed on either side of the boiler. The refuse is brought in by carts and dumped into a trolley car, which is then raised by an electric hoist, of which there are two, to a platform on top of the cells, from which it is run to the hoppers and emptied into the cell beneath. This arrangement necessitates the consumption of a portion of the electric power generated, for operating the hoists and other machinery.

Now to return to the report recently issued. This showed a sale of current, including public lighting, for the last fiscal year amounting to $41,270.52 at the rate of 7 cents per unit. The dust destructor in operating consumed $2,681.41 worth of current, which added to the amount of current sold and including other minor receipts would make $45,205.16 as the sum to be credited to the plant. On the other hand, the coal consumed, presumably in starting the fires, amounted to $2,163.93, which added to the engineer's salary and laborers' wages as well as to interest and amount set aside as a sinking fund, brings the total expenditure so far as the lighting part of the plant is concerned up to $29,282.68, which apparently leaves a net profit of $15,922.48. The refuse destructor account proper apparently shows a saving in the handling of the refuse of $6,266.27, and this added to the profit of the lighting plant makes $22,188.75, from which however a debit balance for steam used, amounting to $8,793.62, has to be deducted. This would therefore leave a net profit and saving of $13,395.13. Providing this is correct, it speaks well for destructor plants in general and the Shoreditch plant in particular. Unfortunately there seems to be considerable skepticism in England as to the correctness of the last figure, apparently owing to the manner in which the figures in the refuse destructor account were gotten at, and one gentleman has placed himself on record as stating that were everything taken into account it is doubtful if the profit would exceed $1,500 to $2,000. Some time ago, referring to the destructor plants in England, we stated that it was the opinion of a well-known American engineer who had made a special study of this method of refuse disposal that these destructors were not as efficient as was claimed, and the severe criticism of the above report by the technical press in England would seem to bear him out in his statement. However this may be, and allowing that a yearly profit of but $1,500 can be derived from an undertaking of this character, the fact that the garbage of a community is being disposed of in an unobjectionable manner and at no cost should still recommend garbage destructor plants for use in thickly populated communities, many of which are to-day disposing of their refuse at considerable expense.

* * *

Tit for Tat. The Manufacturers' Association of Canada has called the attention of the Anglo-American Commission, now holding a series of meetings in Washington, to the fact that the United States Immigration Bureau has recently made a number of rulings to the effect that the commercial travelers of Canada fall within the restrictions of the alien labor law, and that they cannot carry on their work on this side of the border.

In bringing the matter before the Commission the statement is made that a large number of commercial travelers from the United States have regular routes through Canada, and that if this country intends to exclude Canadian salesmen the Canadian Government will perforce retaliate by excluding American salesmen from Canada. Should this proceeding be carried out it will work great hardship to the manufacturers of electrical apparatus and appliances, many of whom have salesmen traversing Canada in every direction in quest of orders, and they will have to be recalled. Efforts will be made, however, to have the restrictions removed on both sides.

Under the Searchlight.

Notes and Comments on Various Topics.

ARRANGEMENTS have just been completed for a fire telephone service for New York City. Telephones are to be attached to every lamp-post holding a fire signal box, which arrangement will permit of a conversation being carried on between the point where the fire is located and headquarters. The district along Broadway will be the first equipped.

* * *

THE trolley car, which displaced the mule in street-railway work, is fast outrivaling that disappearing quadruped as a source of mirth in court proceedings. Only recently in Brooklyn a street car was introduced as a witness (?) in an important case and appeared bodily at the court-house door (being too ponderous to be put directly upon the stand), and was there subjected to an examination by the jury. It proved a convincing witness and won the case.

In a suit at Memphis, which is still going on we believe, a trolley car is the defendant. The suit was brought by a Mississippian on a temporary visit to the Tennessee city, who sought to recover $20,000 damages for such trifling injuries as a broken leg, two broken ribs and a section of his left ear cut off. The defense demurred to his prayer for damages on the ground that he was a stranger in the city and was intoxicated when the accident occurred, as early as 8:30 in the evening. On the stand, the plaintiff explained that he had, prior to the time the car struck him, drank but three glasses of beer and was on his way to visit a young lady. He did not know where she lived, but was standing in the middle of the street looking for her house when the car ran him down. As we have stated, this case is still unfinished, but it is questionable whether a Memphis jury will greatly blame a trolley car for knocking a man over who thought it necessary to fill himself up with beer before setting out to call upon one of their townswomen whose residence was unknown to him.

Another trolley suit that has a bit of humor in it is now on trial in our sister borough of Brooklyn. There is a lady in this case also—two in fact, for the complainant is of that sex. She deposes that she was run down last summer by a car of a Coney Island line on its way to that bewildering resort, and bases her demand for damages on the alleged negligence of the motorman, whom she accuses of carrying on a flirtation with a pretty Armenian girl who was on the platform beside him. The plaintiff, with something of scorn in her words, states that the motorman was so very attentive to the gazelle-eyed foreigner that he failed to put on the brakes in time to save her from a fractured limb. That suit is also still in progress, but a verdict of $1,500 has just been given in the case of a young lady in Newburg, whose claim for $25,000 damages was founded on circumstances that, in contrast to the above, are rather creditable to the car official, whose attentiveness to duty was the cause of the trouble. The claim was that while on the defendant's car the conductor at the request of a passenger pulled down the curtain. Afterwards it flew up and an iron at the bottom fell out and cut a gash in the plaintiff's scalp. It was claimed that she suffered from concussion of the brain, that her nerves were shattered and that her spine was injured, and that she would never recover.

These are the court incidents of a single week in which the subject of this notice is involved, and while they serve to show that the trolley car contributes more perhaps than it ought to to human suffering, it nevertheless makes some amends for its shortcomings by the penalties it has to pay and by adding constantly to the curiosities of literature.

* * *

THE Philadelphia Board of Health, says the *Record* of that city, is the recipient of many queer complaints, but the one it received the other day from a disgusted and nervously prostrated jeweller of Eighth street is entitled to prominence in a class by itself. It seems that the jewelry store is located next door to a phonograph establishment that has for the purpose of attracting passers-by a phonograph going all day long. All kinds of tunes and alleged witty sayings are squeaked forth from early in the morning until late at night in peculiarly penetrating and nerve-destroying tones. At first the machine efforts at wit amused the jeweller, and he used to laugh heartily at the comicalities, but these were repeated with such deadly persistency that they began to pall, and from being amused the tradesman grew into a negative desperado. One day the climax was reached when a customer, who looked like "ready money," came in to buy a diamond ring. For some reason the machine next door was quiet for a while, and the jeweller was just on the point of closing a highly profitable sale when the shrill voice of the phonograph began to sing "Get Your Money's Worth." The amazed customer hesitated, and finally told the jeweller he would call another day. This incident was the last straw, and the Board of Health will now look into the matter.

* * *

THE New York Association of California Pioneers held its annual dinner on the afternoon of December 1. Some twenty-five of these hardy adventurers, who fought their way over the plains or across the Isthmus in '48 and '49, to open up one of the most productive States in the Union, sat down to partake of a repast which was in striking contrast to the salt pork and hard tack they had to content themselves with fifty years before. Many stories of the early days were told and reminiscences indulged in, and needless to say the graybeards enjoyed themselves to the limit.

* * *

RESIDENTS of upper Madison avenue, New York, were treated to a magnificent display of electric fire at 7 o'clock on the stormy evening of December 3. The entire neighborhood and the hill at 135th street were illuminated as if by a great blaze. When the fire shot from the slot of the electric line, between 94th and 95th streets, two cars were close together on the north bound track, while one was about even with them on the south bound track. Passengers in the cars were panic stricken and fled in terror to the streets. Other cars stopped a few feet from the electric disturbance, and their passengers fled to the street and joined the crowd, which watched the efforts of the workmen who rattled up in a repair wagon. Burning out of a fuse under a north bound car is said to have caused the terrifying display.

* * *

A REPORT comes from Baltimore that a concern of that city has bought out the steam tram road at San Juan, Porto Rico, and is planning to convert the line into a modern electric railroad. J. G. White & Co. is the Baltimore concern which engineered the deal. It is contemplated by the owners of the property to not only reconstruct the road for operation by electricity, but also to build a power station that will furnish electric lights.

ELECTRIC FOUNTAINS.*

Their Construction and Operation—Mechanism of the Color Screens and Water Valves—Examples of the Displays.

BY L. S. LEVY.

With the introduction of electrical displays on the stage, not many years ago, there opened a new era for electrical development, and we have to-day many electric appliances designed solely for producing spectacular effect. One of the most ingenious of these—the electric fountain—has gone through so rapid a series of improvements that it is now the principal attraction at illuminated displays, and a source of wonder and enjoyment to admiring thousands.

To the charm of the fountain's display by day, is added at night an aspect so weird and of such exquisite beauty as to suggest to the uninitiated the agency of the supernatural.

The illustration on this page is one of an electric fountain situated at the main entrance to Prospect Park, Brooklyn. This fountain represents in its particular line the highest development of electrical spectacular effects.

The view shown in Fig 1 is illustrative of a group of beehives with vari-colored shafts of water. The tall shaft at the center has been properly termed a "geyser," and is indeed representative of that beautiful manifestation of nature, with the added beauty that the electric light only can impart.

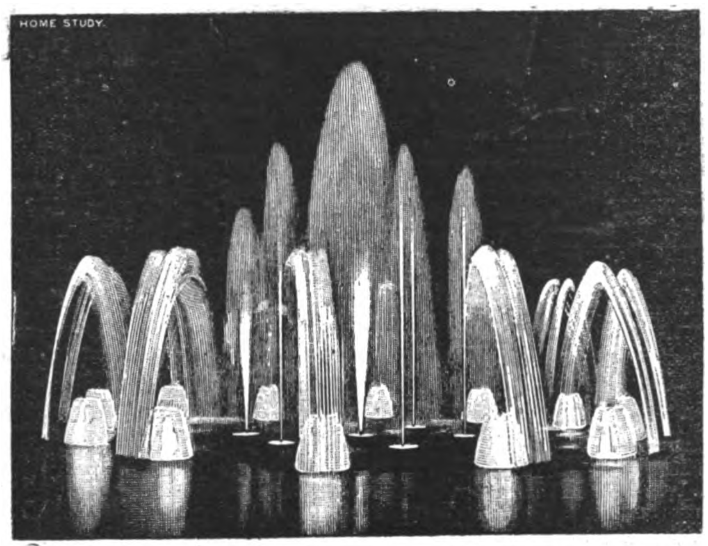

FIG. 1.

The successful combination of a colored beam of light with a directed stream or spray of water whose hues are changed at will is easily arranged. The principle underlying this combination is illustrated in Fig. 2. This sketch shows one method employed for illuminating the stream in an electric fountain. A transparent window g is placed immediately opposite the opening in the fountain nozzle n, and the rays from an arc lamp of special design are projected through the window and into the path of the jet j. A portion of the rays is reflected from the surface of the stream, producing an illumination of the falling drops. A quite different method of securing a diffusion of the rays through the stream was adopted in the design of the Brooklyn fountain.

It is evident that an arc lamp of smaller candle power will be required to illuminate the stream if the rays are thrown directly upon the surface of the stream as it emerges from the nozzle. It possibly provided, in this instance, the only solution to the problem of illumination, as the display is not limited to that produced by solid streams.

The fountain, as shown, is located in the center of a large oval grass plot. The circular base has a concrete foundation and a cement bottom, and has a diameter of about 120 feet. The actual diameter of the fountain proper—that part including the jets—is about 40 feet. Around the inner edge of the cement coping are arranged, at regular intervals, about eighty-eight 25 candle power incandescent lamps, each enclosed in a waterproof globe. They are used for illumination at night when no display is in progress.

The fountain proper, in any case, consists of jets and the illuminating funnels through the colored rays are projected.

Directly beneath the Brooklyn fountain is a large room, in which are installed the lamps, color-screen apparatus, and valves for the control of the water supply. A view of the interior of this room is shown in Fig. 3. In the ceiling immediately above the lamp l is shown the lower end of the aperture, or funnel, through which the light from the lamp is projected. This funnel extends a short distance above the surface of the water in the basin, as can be seen by referring to the illustration of the "Wheat Sheaves," Fig. 6. Surrounding the upper end of each of the funnels (there are nineteen) is a circular pipe, pierced by a number of holes through which the water is projected to form the various combinations of light and color. Protruding from the center of each funnel is a pipe of about 1¼ inches diameter, which assists in the production of the "Fan," Fig. 5, and other pleasing effects.

Below each of the funnels a powerful arc lamp is placed. This lamp is of the focusing-projection pattern, and is provided with a parabolic reflector, in order to direct the rays in parallel lines. The lamp requires for its operation a current of 40 amperes, maintained by an E.M.F. of 50 volts.

The lamp, used as it stands, can only impart a white illumination of intense brightness to the stream. For the purposes of color variation color disks are provided, which are mounted so that they can be brought into the path of the light rays. This detail of construction has been very ingeniously devised, as will be evident from Fig. 3. The screens, bearing diaphragms aa of various colors, are pivoted about a common center b, and when swung through an angle of nearly 90° are directly beneath the funnel, intercepting and lending color to the rays from the lamp l. There is one opaque screen provided for the purpose of darkening the funnel if at any time during a display it is necessary to effect a combination in which all the funnels are not used.

It is evident that, to make the operation of the fountain as simple as possible, the apparatus by which the hydraulic mechanism is operated and the electric lights controlled must be managed by as few persons as is consistent with good results.

Several very ingenious appliances, which almost assume the proportions of independent systems, have been introduced in the installation of the fountain under description. The successful operation of the color screens, in conjunction with the various combinations, determines in a measure the value and efficiency of the fountain.

It will be gathered from what has been said that a system which provides for a concentration of the controlling mechanism has been adopted in connection with the fountain illustrated in this article.

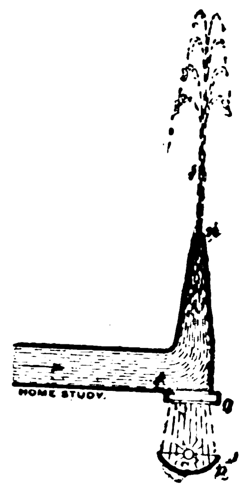

FIG. 2.

The principal part of the system lies in the mechanism that operates the color screen directly, and this, in the case at hand, is made up of a number of cylinders the pistons of which are connected to the arms of the color screens and are operated by compressed air derived from a special compressor, electrically driven.

The control of the air cylinders, illustrated at c, Fig. 3, is effected by means of valves controlled by push buttons. It is evident that, to effect the various combinations, numerous buttons, systematically arranged, must be provided and installed in the most convenient position. The manner of their arrangement can be seen by referring to Fig. 4. Here the buttons constitute a switchboard of no mean proportions and complexity.

As there are eight color screens to each funnel, a separate cable, composed of sixteen No. 24 B. & S. wires, runs from each set of valves to a set of buttons placed on the color board, over the hydraulic valves in the operating room, as shown in Fig. 4. A common return wire is used for all the magnets. Each of these compound buttons consists of sixteen separate pushes in two rows, each button of the top

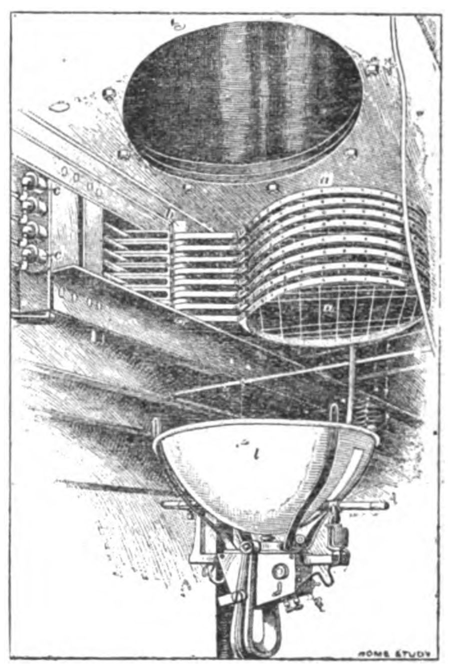

FIG. 3.

* From the *Home Study Magazine*, Scranton, Pa.

row being colored and corresponding with its respective color disk, which is operated when the button is pushed.

In the lower row, the buttons are all white, and each acts as a release button for the colored button below which it is located. An ordinary open-circuit battery is used to operate these electro-pneumatic valves. When the release button is pushed, the air cylinder is exhausted by reason of its connection with the atmosphere, and the disk is automatically

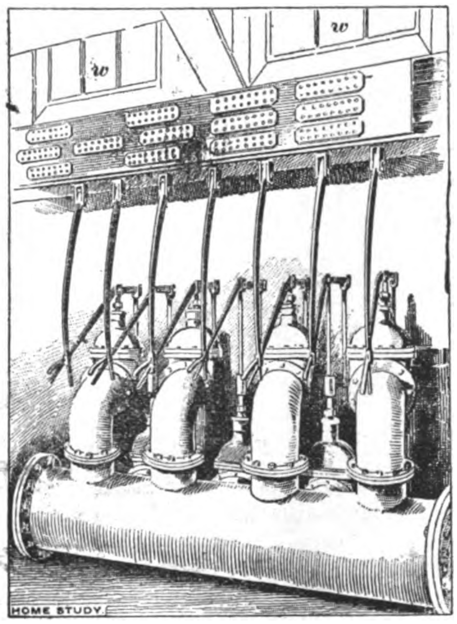

FIG. 4.

returned to its normal position by means of a barrel spring. The carrying levers of each of the color disks are mounted on ball bearings, thus greatly facilitating their operation.

At *w*, *w*, Fig. 4, will be seen two windows, which are located in the side wall of the fountain basin, keeping the fountain in sight of the operator at all times. This arrangement is an appreciable factor in the speed with which the fountain can be operated, as no dependence is placed on the transmission

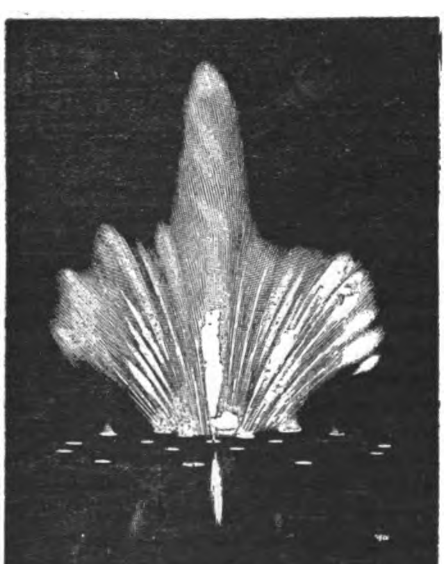

FIG. 5.

of instructions; so that it is free from the mistakes which are bound to occur in the best regulated systems wherein the operator cannot see the fountain.

The concentration of the entire operating mechanism at one point has made it possible to operate the fountain with only two men—one being located on a platform in front of the valves and color buttons, and the other having charge of the lamps beneath the basin. The man at the controlling appliances simply raises the levers to effect any suitable water display, after having pushed the necessary color buttons for the different funnels.

This change of views can be made so rapidly that the fountains may be used for displays of a particular character. For instance, the effect produced in the display pictured at Fig. 5, while in itself a beautiful combination and of magnificent appearance at night, when colored, would be enhanced if the design were some such favorite theme as that of our national emblem.

In excellent keeping with so grand a sight, the

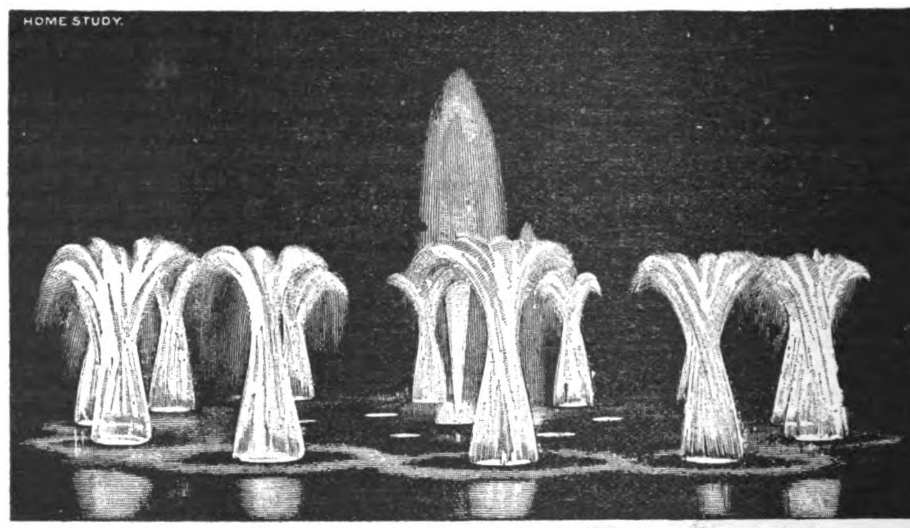

FIG. 6.

change to that in Fig. 6 could be rapidly effected, and a representation given of the prime product of our great West, illuminated in its truly beautiful color—emblematic of national integrity and of the vast resources of the Republic.

THE ELECTRIC MOTO-VEHICLE.*

BY C. E. WOODS.

(*Concluded from page 328.*)

I remember in my first early experience the disappointments which arose in regard to weights, constructional features, controls, etc., and three years ago I thought it would never be possible to build a moto-vehicle with any mileage capacity at all at a less weight than 1,800 or 2,000 lbs., yet to-day I have vehicles in operation which weigh 800 lbs., including everything, and have a mileage capacity of about twenty-eight miles on one charge of the batteries. My work has also developed the fact that as great a range in different vehicles can be obtained as regards size, usefulness, etc., as in any of the prior lines of vehicles, and I have found that for a diversity of design covering nearly thirty different styles of vehicles the whole proposition is confined to what I call four different sizes of equipments; by this I mean four different sizes of motors, batteries, and et ceteras, which are as follows:

My lightest vehicle is equipped with one 2½ HP. motor, 36 batteries of 16 ampere hour capacity for two hours, which run the vehicle at a speed of fourteen miles per hour carrying two people. The weights in all the construction work of this vehicle have been reduced to a minimum, the total weight of the batteries being 440 lbs., about 360 lbs. being in the motor and vehicle proper. To tabulate these different equipments will be the most concise way of putting them, and I will call my first equipment No. ½: passenger capacity, two; complete weight of vehicle, 800 lbs.; weight of batteries, 440 lbs.; average miles run on one battery charge, 20; speed (miles per hour), first 3½, second 7, third 14; number of motors used on vehicle, 1; HP. of same, 2½; number of battery cells, 36; amperes per hour for three hours, 12; time in hours required to charge batteries, 3.

* Read before the Chicago Electrical Association, Nov. 18, 1898.

No. 1 equipment, designed for a top carriage or a heavy buggy: Complete weight of vehicle, 1,150 lbs.; weight of batteries, 600 lbs.; average miles run on one charge, 25; speed (miles per hour), first 3½, second 7, third 14; number of motors used on vehicle, 2; HP. of same, 3; number of battery cells, 40; amperes per hour for three hours, 18; time in hours required to charge batteries, 3.

No. 2 equipment, which is designed for four passengers in an open vehicle such as a trap or break: Complete weight of vehicle, 1,800 lbs.; weight of battery, 800 lbs.; average miles run on one battery charge, 30; speed (miles per hour), first 3½, second 7, third 14; number of motors used on vehicle, 2; HP. of same, 5; number of battery cells, 40; amperes per hour for three hours, 30; time in hours required to charge batteries, 3.

No. 3 equipment, which is designed for both commercial delivery wagons and for my heavy cabs, of which I have built quite a number; also applied to heavy carriages with tops; has a passenger capacity for from four to eight people: Complete weight of vehicle, 2,400 lbs.; weight of batteries, 1,000 lbs.; average miles run on one charge, 25; speed (miles per hour), first 3, second 6, third 12; number of motors used on vehicle, 2; HP. of same, 6½; number of battery cells, 40; time in hours required to charge batteries, 3.

All of these various sizes of equipments have been built by me and applied to different vehicles, and I regret that time before rendering this paper did not allow me to get a condensed compilation of the tests, but I will give one of the large cabs which will have to stand as a criterion for the rest.

The original calculation for the cab read as follows:

Maximum speed of vehicle, miles per hour, 12.

Total load to be carried, including four persons 3,200 lbs.

Maximum HP. required in motors, 5½.

Average HP. required in motors, 4.

Voltage of motors, 72.

Volts lost in transmission in motor, 8.

Maximum voltage required, 80.

Number of cells required at two volts each, 40.

Maximum amperes required, 52.

Maximum amperes per motor, 26.

Average amperes per motor, 22.

Mileage capacity desired at maximum speed, 30.

Hours' discharge required, 2½.

Ampere hour capacity required in battery, 2½ hours; discharge, 110.

Greatest maximum effort required for overcoming inertia and grade climbing, 9.

In accordance with these calculations, from prior experience in smaller vehicles I designed two motors of a nominal 3½ HP. each, either one of which was capable of running the vehicle at a slight overload

under normal conditions of level roadway. The tests of the cabs showed on a macadam and asphalt road a very little difference and called, at a speed of 12 miles per hour, for 42 amperes with a potential of 72 volts at the motor terminals, which amounts to practically 4 HP. In overcoming inertia the amperes would rise with a slight drop of voltage to 65, gradually diminishing until a speed of twelve miles per hour was reached, which acceleration consumes a period of about half a minute.

On these cabs a special instrument, combining both a voltmeter and an ammeter in one case, is used, and I am keeping daily record of their performances under all conditions of roadway and weather, and I find these vehicles wholly adequate to all the conditions to which street traffic is ordinarily subjected.

There has been a great deal of controversy concerning the excessive weight of moto-vehicles and also considerable controversy by some of our theorists about what is considered dead and pay weight, and I want to say here that this limitation has not as yet been reached in my experience. We are perforce obliged to have weight for traction purposes, and many tests made by me on slippery roads, bad places, etc., have proved that with power applied to but two driving wheels we could not reduce our weight more than about 15 to 18 per cent. of what I have already obtained without making it too light for good traction under all conditions of road.

I have also found a very great difference in amount of power consumed in the use of rubber tires. I recently tried a new tire on the above named cab which consumed about 18 per cent. more power than the ones I am regularly using. I also, by very careful tests, have discovered that the hard rubber tire is far preferable to the pneumatic tire for use on moto-vehicles—and this without any reference to its first cost, durability or freedom from punctures. The facts of the case are that the pneumatic tire absorbs more energy by about 20 per cent. when inflated and by a very considerable increase when it becomes deflated to different points of pressure. My first attention was called to this by some tests made by Mr. Kimball of the C. P. Kimball Carriage Company, and I afterwards substantiated these tests myself in another direction, after which I have confined all my designs to the use of wood wheels and hard rubber tires.

The point of control has been a matter of considerable discussion by both those directly and indirectly interested in the development of the moto-vehicle. I have tried series paralleling the fields and I have also tried series paralleling the batteries, after which I have adopted exclusively the series paralleling of the batteries as my method of installation. The one thing to be observed is to have very large contacts and connections and to take the same pains in the distribution of the batteries when in parallel as one does in the distribution of current in the armature. In other words, a uniform resistance of the circuits of the different batteries will produce perfectly satisfactory results in their operation, which I do not find to be the case in series paralleling the fields. This latter can be done to such an extent that but a small rise of current would be made in overcoming inertia, but the excessive amount of field winding will over-saturate the fields unless they are unnecessarily large, and tends to a very considerable loss of voltage in dead resistance, and while we economize in current we do not economize in energy as in the case of series paralleling the batteries.

Three speeds I have found to be sufficient for all practical purposes even on our congested streets, and now have my motors running in parallel entirely independent from one another in their propelling function. Fourteen miles per hour for the larger vehicles I have found to be about the practical limit, as the amount of momentum stored up in the given weights of the vehicles cannot be brought under control by brake application quick enough to be safe on our city streets at greater speeds. In other words, we cannot brake on the moto-vehicle any more than we can on the car beyond the locking of the wheels. In the light road buggy which I have, I have geared it up to 20 miles an hour and find that with 800 lbs. I can handle it with a reasonable degree of safety on boulevards and parks, but I do not recommend these speeds to go any higher as a general proposition, although as a racing proposition I believe that the moto-vehicle will be brought down to 1½ minutes for a mile, or perhaps even less.

I regret very much that time will not permit me to go into the question of storage batteries for moto-vehicles, but as this has been a line of development confined entirely within itself for use on the vehicle rather than in the vehicle proper, I have not undertaken its diagnosis in this paper. I will say, however, that there are three different batteries on the market now which seem to be fulfilling the requirements, and as a comparison I will take the cab battery.

One make weighs 1,120 lbs. and a 36 ampere discharge for three hours; one weighs 1,500 lbs. for a 37½ ampere discharge for 3½ hours; and one weighs 1,000 lbs. for a 36 ampere discharge for three hours. The ratios of capacities and weights are the same for all other sizes.

I sincerely hope that those directly interested in the development of the storage battery for this purpose will in the near future deliver to us some information regarding difficulties they have had to overcome. I am frank to say that my experience up to date with the storage battery has more than met my expectations alike in capacity, weight and durability, and with such improvements as may be made from this time on there need be no further anxiety regarding the success of the storage battery in such work. I have tried these vehicles under every condition of road and work that the vehicles can be put to, and my troubles with the storage battery have been far less under intelligent care and treatment than the public generally credits it with.

I noticed recently in one of our leading journals an editorial which stated that the hardest problem is the storage battery, which will "sputter, fume, give out on the road, leak, disintegrate, corrode, short circuit," and so on, and I think that the gentleman who edited this article must have taken very little pains to inform himself as to the general status of the storage battery as it is being used to-day in the moto-vehicle. It would be just as consistent for him to say that electric power and light plants were impracticable because boilers would burst, engines break down, armatures burn out, street construction blow down, etc., etc., all of which we know are possibilities but are not probabilities under the advanced stage of the art.

From all this it would seem that there has been just as much engineering work in the development of the moto-vehicle down to the present day as there has been in many other propositions, and it is with great pleasure that I find many of the engineers in other directions so interested in the proposition, notwithstanding the fact that but few of them have considered it solely from an engineering point of view. It promises to be a great industry and ultimately will throw large professional work toward other engineers than those directly interested in its manufacture; and it will always be a personal pleasure to me to give such practical illustration and information as lies within my power to my fellow-craft.

An Electrically Operated Factory.

It is stated that a new hardwood flooring factory, now in course of construction at Cadillac, Mich., will possess the unique character of being destitute of shafting and of having but one driving belt—that one driving the dynamos. There will be eight flooring machines, boring machines, end matchers, and other tools necessary in such a factory, each machine having an independent electric motor.

THE NEW ELECTRIC CRANES AT SOUTHAMPTON HARBOR.*

The completion and official trial, last week, of the new electric cranes erected by the Southampton Harbor Board, and their impending taking-over from the contractors, Messrs. Stothert and Pitt, of Bath, render opportune a description of these interesting machines and some account of the reasons which have led to their erection. We may say at the outset that, through the courtesy of Mr. J. G. W. Aldridge, the electrical engineer to the Southampton Harbor Board, we have recently had an opportunity of inspecting these cranes and of seeing them in operation.

In 1892, owing to the close competition between the harbor and the docks at Southampton, a committee of the Harbor Board was formed which, together with Mr. Aldridge and Mr. W. Bowyer, the energetic traffic manager, visited several Continental ports, with a view to discover the best means of expeditiously and cheaply handling cargoes by harbor cranes. Mr. Aldridge presented a report recommending the use of electric power, with the result that in 1893 the two 3-ton electric cranes described at that time in *The Electrician* were erected by Messrs. Statter & Co. So convinced did Mr. Bowyer quickly become as to the superiority in every respect of electrically-driven over every other kind of crane that he recommended an extension of the number of these cranes, and in 1896 specifications were drawn up by Mr. Aldridge and issued to contractors. A tender was accepted for three 3-ton cranes and one combined 12-ton and 3-ton crane, the complete equipment being carried out for £7,288.

While the new cranes somewhat resemble in general appearance the older pair erected on another quay, they differ in many respects from these as regards essential points of detail. One of the most interesting of the new departures is the arrangement for automatically ringing an electric bell in the cabin when the crane is set to hoist too great a load. The sheave at the end of the jib, instead of being carried in a rigid bearing, has its bearings supported in guides on a steel coil spring. Excessive load compresses this spring sufficiently to close an electric circuit and ring a bell in the cabin. Another interesting feature attaches to the combined crane, the provision for which arose out of the necessity to have a 12-ton crane as a stand-by, although it would be infrequently used as such. Mr. Aldridge wisely decided not to have a separate stand-by crane, but to combine the 12-ton hoisting gear with a 3-ton crane; and this he has done by an ingenious arrangement of gears, whereby the motors are made to operate at will either the smaller or the greater hoist, the slewing gear being the same in both cases. Change from one hoist to another can be effected in 55 sec., and is quite a simple matter.

The 3-ton cranes are constructed to lift 30 cwt. at 200 ft. per minute on a single rope, and three tons on a double rope at a proportionately lower speed. The radius of the cranes is 30 ft. and the normal slewing speed 400 ft. per minute with a 30 cwt. load. Two separate electric motors operate the hoisting and slewing motions, the hoisting motor being rated at 50 HP., and running at 600 revolutions per minute, and the slewing motor being rated at 10 HP. The lifting motors of the 3-ton crane are not reversible, and have copper brushes on the commutators; the lifting motors for the 12-ton have carbon brushes, being reversible. The slewing motors are all provided with carbon brushes. All the motors are of the two-pole drum-wound shunt-field type; they are supplied with current at 200 volts from the Corporation supply station. The pole-pieces are hinged to facilitate inspection. On the motor spindle is carried a Delta metal triple worm, gearing into a cut steel helical gear, the gear running in an en-

* From the *Electrician*, London.

closed oil bath. The gear wheel of the lift motor in the 3-ton cranes carries the main drum, but in the 12-ton crane it actuates a throw-out back gear, similar to that employed in lathes, by which the interchange is effected. The back gear actuates either the 3-ton or the 12-ton hoist, the other hoist being locked.

The lever for working the hoisting motor, and the wheel for operating the slewing motor, in each case actuates automatically the regulating resistance of the motor fields. As the lever passes over it pushes a number of plugs resembling cornet pistons, these being thrown in seriatim, and each plug short circuits part of the resistance by a carbon contact. We believe this method was first adopted by Messrs. Siemens & Halske, of Berlin, by whom the regulators were supplied for these crane motors.

Each crane cabin is provided with a convenient switchboard, carrying the electric switches and Evershed indicating instruments. The field and armature switches are interlocked. In each cabin there are two 32 CP. "Ediswan" glow lamps, also plugs for portable lamps, and near the top of the jib there is a group of glow lamps arranged in a reflector.

The manner in which current is led into the revolving cabin is of interest. In the center of the floor there is an insulated box containing a brass ring rigidly fixed to the floor. Inside this ring, and pressing against the inner surface of the ring, there is a copper brush of peculiar shape, rigidly connected to the stationary frame of the crane. This brush carries the current into the crane equally well whether the cabin be stationary or moving in either direction. Current is brought to the crane through flexible diatrine cables. One end of the cable is attached to the crane; the other can be attached to any one of the connecting boxes along the quay. From the power station to the quay boxes the current is carried in bare copper strip laid in wooden troughs. The consumption of power is found to be from 3½ to 5 units per hour, and the present price charged is 3d. per unit, but it is expected that the price will shortly be reduced.

Even at the comparatively high price charged for current there is no doubt about the superiority of electric cranes for handling cargoes cheaply and quickly. Much more work can be got out of the cranes when in commission; they are less liable to get out of commission through breakdown, and are much more quickly repaired when breakdown occurs; and the cost of repairs is so trifling that at Southampton no separate account is kept of them. There is a great saving also in standing charges, since the same generating plant can be used—as it is at Southampton—for lighting the harbor and the town.

It is sometimes stated by parties interested in rival kinds of cranes that electric cranes require specially skilled operators and cannot be placed in the hands of ordinary crane-men. This mythical notion has been completely exploded at Southampton. Not only have men quite unskilled in electrical machinery been put in charge of the cranes, but they have acquitted themselves even better than the one or two men who possessed some knowledge of electric motors and their appurtenances. Curiously enough, the best craneman at Southampton—the man who "can make the cranes speak," who can get more out of them than anyone else—is a workman quite ignorant of electrical machinery; yet he has never had a breakdown; on the other hand, an electrical man who for some time had charge of the cranes was frequently responsible for interruptions. Facts like these speak for themselves.

A Large Scotch Water Power Scheme.

An effort is being made in England to get the necessary rights and privileges for the carrying out of an extensive water power utilization scheme in the north of Scotland. It is proposed to erect a generating station near Loch Leven and utilize water power derived from the neighboring river and lochs as far as Loch Ericht. Dams are to be constructed to divert the waters of the Allt Glas into Loch Ericht, and for the purpose of raising the waters of Loch Ericht, by damming the river Ericht where it flows out of the south end of the lake so as to submerge the neighboring land. An aqueduct will be built as a communication with the two streams, Allt Coire a' Guibhais and Allt Dubh Garbh, and the waters of these streams will also be impounded.

POWER GAS FOR TRAMWAYS.

Steadily, if somewhat slowly, says the London *Electrical Review*, the idea of gas power advances and takes deeper hold, and in support of this view gives an abstract of an article in *Le Genie Civil* describing the electric tramways at Lausanne, which are notable as being dependent for their motive power upon a gas plant.

Coal is so dear a fuel in Switzerland, that the country's large store of water-powers has been much drawn upon for power purposes, and the use of electricity has become quite common. In England we have no water-power, and such cheap gas that much of the impetus present in other countries is absent. At Lausanne presumably water-power was not available, at least for the particular purposes of the tramways, and the choice lay between steam and gas, and was solved in favor of producer gas, though several steam engine builders offered to guarantee a steam expenditure of not over 22 lbs. per effective HP.-hour, or 2.48 lbs. of coal with an evaporation factor of 8. Gas power plant builders, however, offered power for 1.137 lbs. of coal per HP.-hour, and the plant has worked two years. It includes three Crossley engines of 130-HP. each, and three revolving bottom Taylor generators worked by superheated steam blast and air, the result being a mixture of part water gas and part power gas of higher calorific power than ordinary producer gas. It is cooled, scrubbed, and purified, and passes to the engine via a holder. The clinker is removed by revolving the generator bottom once a day. The engines have each two opposed cylinders on one crank, and this gives steadiness with a 6-ton fly-wheel. The jacket water is circulated and sprayed and used over and over again. It seems strange so near Lake Geneva to find water scarce.

The generators are of the Thury type, feeding a 300-element battery of 700 ampere-hours capacity. This serves to equalize the load. The line is eight miles in length and less than one mile is on a level. The maximum grade is 11.3 per cent., and is operated by adhesion alone. The cars seat 32 passengers and have each two Thury motors of 20 HP. The overhead system is employed, and cars have an independent electric brake as well as a hand brake.

During the first half of 1898 the fuel consumption was 850,000 lbs., the output 413,849, or equal to 2.05 lbs. of fuel per kilowatt. The fuel includes all fuel burned, even that for finding distilled water for accumulators. With steam engines the fuel expenditure per KW. would be 3.78 lbs., so that by the use of gas there has been effected an economy of $4,000 annually. This installation is but another proof of the economy to be derived from the use of producer gas. Undoubtedly the gas engine has been helped by the fact that illuminating gas has been so ubiquitous, but at the same time it has also been retarded by the great comparative unit cost of such gas, and the ideal gas has not been understood. Producer gas need not necessarily require a steam boiler to work its plant as at Lausanne. Equally good results are obtainable with gas plant operated by fan blast, any water being added from the wet bottom or hearth or by spray into the blast pipe. The object in view when a manufacturer or mill owner puts down gas plant is not to have gas plant plus a steam boiler but gas plant simply, which shall enable him to abolish the boiler altogether. Where this has been done we know that the question of fuel expense has lost much of its previous seriousness to the power user.

A FRENCH VIEW OF AMERICAN ELECTRIC TRACTION.

With a view to the adoption of electrical methods on the line now constructing between the old Orleans station and the new terminus, says the *Electrical Review*, London, the Orleans Railway Company sent to America on a voyage of study a group of engineers, Messieurs Solacroup, Sabouret, Valton, De Fremინville and Hiberty.

Their notes are published in the *Revue General des Chemins de Fer*, and are of the customary excellent quality which distinguishes the work of French engineers. *L'Industrie Electrique* gives extracts from which we have endeavored to cull. Our contemporary is brilliantly sarcastic at the expense of the Heilmann locomotive.

"While we are losing our time on the Heilmann locomotive, the Americans are utilizing, with success, experience gained in exploiting electrical tramways in the development of electrical traction on main line railways—*leaving the generating station at home.*"

The sting of this, as of many other things, comes in the tail. The Heilmann locomotive, as we all know, does not leave its generating station at home; but—snail like—bears it on its back a constant load and incumbrance. Here we have a genuine French opinion of the wisdom of it.

In ten years electrical traction has almost entirely supplanted horse traction and cable lines in America. New lines have been established at the same time as electric lighting in small towns, in the suburbs of large towns, reaching out to distances impracticable for either horse or cable roads; uniting the principal localities at 40 to 50 kilometers apart, and endeavoring by the junction of suburban network to raise up traffic between neighboring towns. By the current year 20,000 kilometers had been constructed, and bid fair to grow still faster in the immediate future. And London is thinking of experimenting!

From tramway work main line work has been taken up simply by carrying out everything on a little larger scale. Though so new on main line work—scarcely three years—electric traction has already been applied, so far as the deputation were aware, to the tunnel of the Baltimore & Ohio, to certain branches and sidings at Hoboken, New Haven and Whitingsville, the Boston and Nantasket Beach, Hartford and Berlin, Berlin and New Britain, the Lake Street and the West Side Elevated of Chicago, Washington and Mount Vernon, Burlington and Mount Holly, Norfolk and Ocean View, and on a little branch line of 5 kilometers in California.

We have repeated the list for the benefit of the London Metropolitan Railway, whose directors incompetently shiver between wind and water, afraid to venture, in their ignorance on the one hand, and fearful of rendering passengers too comfortable on the other hand.

The circumstances which compelled the adoption of electric locomotives in the Baltimore tunnel, in order to enable the company to compete for the New York traffic, are too well known to require any repetition from the French. The deputation observe that the service rendered is complete and regular. Electric locomotives alone haul freight trains also through the tunnel, and they note that all engineers, without exception, are satisfied. The third rail as a conductor has their approval rather than the overhead conductor, in that weight for weight copper has only from five to nine times the conducting power of steel, but it costs 1.05 franc per kilo, whereas steel rails (old) only cost 65 francs per ton (1,000 kilos). For other reasons, also, they approve the third rail. It appears to them a little out of the way to employ locomotives of 87 tons for a daily service of 15 trains when twice the number of trains might be worked with engines of half the weight; 22 tons per axle seems heavy. The engineers of the line consider, however, that the splitting up and re-

forming of trains would be worse than the inconveniences named. They would also have preferred a simple reduction motor in preference to direct connection for such slow speeds as are employed, and an increase in the number of axles. By this change the motors could run so much faster and be correspondingly less.

But, on the whole, great satisfaction is expressed, especially in view of this being the first application to main line work and that the service rendered is double—freight and passenger—the four motors being coupled in series for heavy loads, while for passenger trains the working is in parallel of other locomotives since made by the General Electric Company, that of the manufacturers' line at New Haven weighs 25.4 tons and has two motors, one on each four-wheeled truck, driving one axle direct at 500 volts. At Hoboken a 25.8-ton engine has a geared motor to each of its four axles. This is highly commended.

With a total weight of train of 239 tons on a run of 1.76 kilometers in 3 minutes 17 seconds, the total energy consumed was 14.5 KW. hours, or 34.4 watt hours per ton kilometer.

The cost of production is .0404 franc per KW. hour. Adding 10 per cent. for line loss, gives .044 franc (say .44d.). The electrical cost per 100 tons per kilometer is thus 1.54 franc, or practically 1½d., equal to 22 kilos. of coal. This includes all works' costs.

On the Berlin-Hartford line about 20 per cent. of the motors are off duty, which is declared small for machines doing their 570 kilometers per day. On the Nantasket Beach line, with 60-ton trains at 60 kilometers speed, the consumption of electricity varies from 37.3 to 50.8 watt-hours per ton kilometer. This is higher than at Baltimore, especially when it is considered that the line is nearly level, and at Baltimore the grade is considerable, but at Nantasket there are many stops—14 in 17 kilometers.

On the West Metropolitan of Chicago trains run at two minutes' headway. The motor cars weigh 26 tons, and draw during the daytime three trailer cars. The motor cars have two 125 HP. motors, one on each axle of one of the bogies. The journey speed is 24 kilometers per hour at a cost of 77 watt-hours per ton kilometer. The motor cars are overhauled every 40,000 kilometers, or about every four months. This occupies three days; 6 per cent. are under repairs. The chief overhauling is that of the armature. Stations only average 600 meters apart.

The necessity of attracting passengers by high speed has led to the construction of new motor cars with four motors of 150 HP. in place of two of 125 HP.—with a view, also, to hauling four trailers.

Full appreciation is awarded to the Sprague system of all motor car trains with synchronous working, whereby Mr. Sprague hopes to get up a velocity of 64 kilos per hour in 20 seconds, run at a speed of 90 kilometers, and employ 20 seconds in a brake stop, so securing on runs of only 500 to 600 meters a journey speed of 35 kilos per hour. Such is the order of ideas of American engineers. The French engineers see no further difficulty ahead; overhead or below, the conductor is equally practical, and a third rail on blocks of paraffined wood is fully shown at Chicago to deal perfectly with trains of 108 tons on 2 minutes' headway. General forms have already been established, and all apparatus has been brought to a size beyond what is required for the heaviest trains in France.

No more can the electric locomotive be looked upon as experimental. Daily work over many months has demonstrated its superior tractive power over steam, and its reduced weight for equal power. Improvement, it is true, is still possible, but the electrical locomotive no longer requires inventing. It is there and has come to stay.

TRANSMISSION OF POWER BY ELECTRICITY.*

The greatest achievement of the century which now approaches its close is the intimate connection that has been established between science and practice, the effects of which are noticeable in every feature of modern civilization, and in none more than in electrical engineering.

A little over thirty years ago the dynamo-electric machine was invented, which made electrical engineering of practical utility; but long before that time the laws of nature had been discovered by scientific research which govern the flow and the distribution of electric currents, Ohm's and Kirchhoff's laws, and which permit of the accurate measurement of the same, Weber's, Ampere's and last, but not least, Faraday's researches.

In no other domain of human activity has it ever been possible to attempt the solution of problems with an equal certainty of being able to criticize the proposed methods by the light of well-established scientific rules, and of avoiding unnecessary trouble and expense when these rules showed an error in the reasoning.

This facility of verifying results accounts for the rapidity of the progress of electrical engineering, and for the variety of purposes to which electricity is nowadays applied.

Among these transmission of power promises to become one of the most important, and it may not be uninteresting to study its development a little more in detail.

Although telegraph instruments and indicators generally belong, strictly speaking, to this branch of the subject, the term "transmission of power" is usually only applied to cases where electric motors are employed to convert electrical energy into mechanical motion.

The first important development took place in connection with electric tramways, starting from the small circular line exhibited in Berlin by Dr. Werner Siemens in 1879.

With our present experience there is no need to dwell on the advantages of electric traction in the streets of towns and their suburbs, and there is little doubt that in the near future horse and steam tramways will disappear everywhere.

Up to now cable traction has held its own in all cases where exceptionally heavy gradients have to be dealt with, but means are devised to overcome such gradients with the help of electric motors, and in this field the ultimate triumph of electricity is also assured.

This great success on tramways has naturally led to attempts to move the trains on the railways by means of electric locomotives, and it is well known that even the heaviest goods trains can be drawn by electric motors as well as by steam locomotives.

It would be a fallacy, however, to deduce from this fact the conclusion that it would be advantageous to replace the locomotives on all existing railways by electric motors, as the feasibility of such changes depends ultimately only on economical considerations.

The changes may be technically possible, but an alteration can only be introduced if a saving in expense is thereby effected.

This principle governs not only electric traction, but the whole field of human progress, which proves the necessity of investigating the economical aspects of a problem after its scientific features have been examined and found to be based on sound reasoning.

In the case of transmission of power there are three factors, common to all systems, which determine the cost of the motive power at the place where it is utilized, and thereby indicate what is the proper system to use.

* A paper read by Alexander Siemens before the British Association for the Advancement of Science.

The first factor is the source of the energy that is to be distributed.

The second is the means of transmitting; and

The third the apparatus for utilizing the energy.

With regard to the first point, the electric system is hampered by the fact that the available mechanical energy, however produced, has to be converted into electrical energy, and such a transformation always involves losses, which are avoided where the mechanical energy can be applied direct to the means of transmission.

As the cost of generating electricity decreases up to a certain point with the increase in size of the dynamos, it is desirable so to arrange the whole system that the units of the generating machinery can be constructed large enough to give the most economical results, and so to choose the site of the generating station that all the necessary supplies can be obtained in the cheapest manner.

In spite of the drawback mentioned above, electric transmission of power is applicable in a great many cases on account of the unquestionable superiority of the means of distributing electricity over the means of dealing with any other form of energy.

The ease with which the current can be carried over a long distance, the certainty with which the losses can be determined beforehand, and the flexibility of the conductors, constitute advantages which no other system presents, while the inevitable loss of the double conversion, added to the losses in the conductor, militate against the application of electricity in cases where the source of power and the apparatus for utilizing the same can be brought close together.

As the efficiency of electric motors has been accurately determined, there is no difficulty in predicting how much of the mechanical energy produced by the original source of power is available for useful purposes, and it is easy to ascertain from time to time that the desired electrical conditions are maintained.

It is well known that over 84 per cent. of the indicated horse power of a steam engine is available at the terminals of the dynamo in the form of electrical energy, and that electric motors will produce over 90 per cent. of the electrical energy supplied to them in the shape of mechanical power.

These high efficiencies were obtained at a comparatively early period, and it was therefore obvious that the main advancement in the electric system must be sought in diminishing the cost of the conductors without increasing the loss of energy during transmission.

Guided by the teachings of science, nearly all inventors have attacked this problem by suggesting an increase in the pressure of the current in one form or another.

Under the impulse of this tendency the art of insulating electric conductors has steadily improved, and while it was not long ago considered impracticable to work with currents of more than 2,000 volts pressure, there are now a number of successful electric systems employing currents of 10,000 volts pressure, and insulated conductors for even higher pressures can easily be obtained in the market.

More serious difficulties appeared when attempts were made to construct dynamos and motors for high pressure currents, and many ingenious devices have been suggested to overcome or to avoid them.

In case of alternate currents the employment of transformers permits the use of low-pressure generators and motors, while high-pressure currents transmit the energy through the conductors, but this advantage is obtained by introducing another loss through the double transformation.

Without much explanation it is easy to understand that the advantage of such a system is the greater the further the source of power and the motors are distant from each other.

Another advantage of this system is that the transformers have no moving parts, so that they require

next to no supervision, and that they do not occupy much space.

If an equally reliable current motor had been invented there is little doubt that this system of transmitting power would be the dominating one at the present time, but unfortunately alternating current motors up to now refuse to start without being first synchronized by external means, they are liable to stop abruptly when they are overloaded, and their speed cannot be varied.

A great step toward the solution of the problem was made when the possibility was discovered of combining three alternating currents in such a way that return wires can be dispensed with.

The result is brought about by employing three alternate currents with their phases differing by 120 degrees, so that their sum is at every moment zero.

At the same time a revolving magnetic field is produced in the field of the motor, so that its armature can start revolving without being first synchronized.

In certain cases it is not even necessary to supply currents to the armature, in which the currents will be induced by the revolving magnetic field, so that all difficulties of making contact with the revolving part of the motor are avoided.

As in the case of single-phase alternate currents, stationary transformers can be used with three-phase currents, which therefore present very conspicuous advantages for transmitting power.

On the other hand, a continuous current system is decidedly simpler, and consequently cheaper in first cost and cheaper in maintenance, provided the dynamos and motors can be well enough insulated to permit the use of high tension currents.

The transformation losses are avoided, and the motors can be made extremely efficient for large differences in their load, and their speed can be varied without much trouble, both qualities in which the three-phase motors are deficient.

As there are continuous current generators regularly supplying currents at more than 2,000 volts pressure, it is evident that this system can be applied in all cases where the distance between generator and motor is not excessive, and indeed in most cases where electricity is employed to distribute power in factories continuous currents are preferred.

Such an installation, viz., the electric plant at the works of Siemens Bros. & Co. at Charlton, was described by the author in December, 1894, before the North of England Institute of Mining and Mechanical Engineers at Newcastle-on-Tyne, and since that time very valuable experience has been gained there with regard to the suitability of electric motors for driving machinery.

Six years' work has shown that the system is perfectly reliable, and that the expected great saving in the cost of attending to the motive power has been fully realized.

During the year 1897, the output of the generating station was 1,178,286 B. T. U., or a load factor of .18. In May and June this year some tests were carried out to determine the consumption of coal and water per Board of Trade unit, and the output in one week was found to be during day time 21,283 B. T. U., or a load factor of .35, and during night time 6,047 B. T. U., or a load factor of just under .10.

During these trials Yorkshire hard coal was used, having an evaporation power of 13.8 pounds of water, as compared with Welsh coal, 14.5 pounds; in day time 5.13 pounds of coal were consumed per B. T. U., and at night 10.42 pounds, showing the immense influence of the load factor, while the average consumption was 6.55 pounds of Yorkshire coal per B. T. U.

Allowing for the difference in heating value the 1,178,286 B. T. U. in 1897 were produced by the burning of 3,282 tons of Welsh coal, while the boilers of the central station consumed altogether 6,514 tons.

It is therefore fair to charge half the actual expenses connected with the boilers to the generating of the electric current, while the other half falls on heating the works and driving some steam engines which have not been replaced by electric motors.

(To be continued.)

AN ELECTRIC POWER PLANT IN THE TRANSVAAL.

At the Sheba mine in the Transvaal an electric power plant has recently been established from which power is transmitted five miles to the mill. When the mine was first operated ore was hauled to the mills by ox-wagons, but later an aerial tramway was put in. This reduced the cost of transporting and milling the ore from $7.80 a ton to $1.46. The establishment of the new mill and the use of electricity generated by water power have, it is claimed, reduced the cost to the very low figure of 40 cents a ton.

In a paper recently read on this installation before the Institution of Civil Engineers in London, as reported in the *Engineering and Mining Journal*, Mr. W. B. Esson said the water power is obtained by a dam across the Queen's River, two miles above the generating station, to which the water was conveyed partly in open race and partly in tunnel. The maximum head derived was 32 ft. The turbines were of the Victor horizontal type, driving a countershaft at 300 revolutions per minute by ropes, and were together capable of developing 396 HP. They were provided with Snow governors, acting directly upon the turbine gate.

The generating plant consisted of three alternating-current dynamos supplying current at 3,300 volts. Each generated two alternating currents having a phase difference of 90°, and was capable of giving an output of 150 electrical HP. The armature was stationary and the field magnets rotated at a speed of 400 revolutions per minute. The stationary high-pressure coils were mounted on laminated iron sectors, which were laid close together in a strong cast iron cylindrical shell made in halves to form the armature. This was 54 in. in internal diameter by 12 in. wide, and within it the field-magnet rotated. Each coil was wound on a former, and had 63 turns of double cotton covered wire 0.12 in. by 0.09 in. in seven layers. The adjacent layers are carefully insulated by micanite cloth, while the complete coil was boiled in paraffin, and was afterwards heavily covered with impregnated tape to a thickness of 1-16 in. In addition, during the process of mounting, a trough of fiber was interposed between the coil and the iron core.

There were 14 coils on the armature, the seven upper coils being for one phase and the seven lower coils for the other; each therefore contributed about 470 volts to the circuit. The coils were displaced to give the phase-difference by the interposition of idle laminated sectors. The field magnet was excited by a single coil and consisted of a steel wheel, from the rim of which projected two series of poles, N on one side of the coil and S on the other. The poles were expanded on the face and were curved to form a circle of 16 alternate faces, which were presented to the armature core, with an air-gap of 0.33 in. The exciting coil was wound on a cast-iron drum placed in the middle, between the projecting poles, and was positively driven by a couple of pins screwed into the steel casting. It terminated in a pair of gun-metal rings lying side by side upon, and insulated from, a substantial cast-iron brush, which in turn was keyed upon the shaft. The exciters were ordinary two-pole upright machines.

For throwing the alternators into parallel the incoming alternator was plugged on to the synchronizing bars, and when approximate synchronism was indicated by the hot-wire voltmeters it was thrown into the main circuit by closing, through a large choking coil, a path between the synchronizing bars and the main omnibus bars. The choking-coil prevented a large rush of current, due to difference of phase, between the alternators, though at the same time allowing sufficient current to pass to pull the new machine into step. The current was transmitted by cables to the mine, and at the receiving house the pressure was reduced to 100 volts for driving motors and lighting the workings. The frequency at which the plant worked was 53.3 per second. The conductors were laid underground, and consisted of concentric cables insulated with impregnated jute covered with lead and armored. There was no fall of potential due to self-induction in the cables, nor had the current in one pair of conductors any inductive effect on the neighboring pair. But when overhead wires were employed, the conductors, being of necessity some distance apart, there was not only a fall of potential due to self-induction in the lines, but unless precautions were taken the mutual induction of the circuits carrying currents of a quarter-phase displacement tended to produce inductive dissymmetry throughout the system.

At the receiving-house there were four transformers of 50 KW. capacity, two for each phase; those reduced the pressure from 3,000 volts to 100 volts. The motors were of the induction type; their construction was fully described, and the author also explained their working under varying conditions and gave a brief account of the laws which governed their action.

The crushing mill at Sheba worked night and day; and in one year, of the possible 365 days of 24 hours each, the pressure had been cut off the conductors for only 4 days 8 hours 22 minutes, which had been chiefly occupied in inspecting the water race, overhauling the belts, ropes, etc., and in executing general repairs to the machinery. The efficiency of the plant from the turbine shafts at the generating station to the motor shafts at the mine might be taken at 70 per cent.

What Instrument Will They Use?

Frank S. Gardner, secretary of the new People's Telephone Company, New York, was asked a few days ago by a representative of the *Evening Post* what telephone his company would use when it began business, the statement having been repeatedly made in behalf of the present (New York Telephone) company that they controlled all the available telephones and the patents in relation thereto. Mr. Gardner in reply said he must for the present decline to give the desired information, but he added that the public might rest assured that his company would be ready for business in a few months, and that as a telephone company could not do business without a telephone and the other necessary paraphernalia, it followed that the People's Company were not making contracts to give a telephone service without having a telephone. More than that he could not say at present.

LONDON NOTES.

[From our London Correspondent.]

The "Underground" Railway and Electricity.

Contracts have just been placed for a series of experiments in electrical working on the Metropolitan Underground Railway. For many years the matter has been under the eye of the Metropolitan and Metropolitan District Company directors, and to the present trials each company contributes a moiety amounting to $50,000. Under the guidance of Sir J. Wolfe Barry and Mr. W. H. Preece, work will be immediately proceeded with for putting down a generating station and plant, temporary in character, equal to the haulage of the heaviest train run on the lines. The train will be run between Earl's Court and High street, Kensington, because the gradients are steep—sometimes 1 in 40—and because the ordinary service at this point is not so frequent as at other points. Therefore the electrical system will be tested under the severest conditions likely to be imposed, and in this way the companies and their advisers will be able to see whether it is advisable to proceed with the electrical equipment of the entire railways. There will be no interruption to the ordinary steam service during the trials, which are expected to be started next summer and to be continued for about eight or ten months. Two conductors are to be laid parallel between each of the lines of the permanent way, and these will be of a permanent nature so as to be of use when the complete equipment is carried out. There are those who hold that the Metropolitan companies need have no hesitation in carrying out a complete conversion without making these experiments, American experience being amply sufficient to go upon, but the directors do not feel inclined to lay out two and a half million dollars (the estimated cost), without having first demonstrated to their own and their shareholders' satisfaction of what electricity is capable when applied to a line with the peculiar features of the Metropolitan. To those who have to use the railway the likelihood of a change is very welcome.

The English Telephone Service.

Applications continue to be made to the Postmaster-General for municipal telephone licenses. It appears however that there is some action in contemplation by the Government during the forthcoming Parliamentary session. The Manchester Corporation, which has long been anxious to secure an improvement in the present service, has decided to withdraw its application for a license to establish an exchange, simply because of the anticipated action on the part of the Government. Does this mean that a proposal is coming forward for the immediate purchase of the monopoly instead of waiting until 1911? Whatever the developments may be, the above announcement possesses special significance.

Electric Traction Economies.

In ELECTRICITY a few weeks ago was notified the opening of an experimental trolley line at Glasgow. Mr. Young, the tramway manager, now reports to the Corporation that the cost per car mile for a fortnight has worked out at 6½d. and the receipts at 1s. 4½d. a profit of 10d. per car mile. These figures have been produced to convince the Corporation of the economy that would result from the electrical equipment of the other 28 miles of track. Mr. Young has also drawn up estimates showing how much greater will be the initial outlay and the working cost if the conduit system is introduced on the entire city service. The Corporation will shortly consider the matter, and doubtless ere long there will be some good contracts to let at Glasgow for traction material. The figures showing the cost of operating the New York conduit system are being widely circulated here, and are creating a feeling in some quarters in favor of the conduit.

THE MECHANICS' FAIR, BOSTON.

Attractive Electrical Exhibits of Various Companies.

At the 20th Triennial Fair of the Massachusetts Charitable Mechanic Association, at this moment in the zenith of its popularity judging from the crowds which daily throng its capacious building in every part, electricity, in almost every phase of the art and science, forms without doubt the most extensive and popular attraction.

Nothing, surely, shows like changes and development as does that of illumination as shown in the marvelous transformation of the "tallow dip" and whale-oil torch in popular use when Paul Revere of historic renown was chosen first president of the Massachusetts Association into the brilliant electric lamps which to-day render the exhibition now being held a marvel of light and artistic effects, alike on the exterior and throughout the interior of the mammoth exhibition buildings.

But "illuminating" does not by any means represent the sum total of what electricity is doing at this exhibition. By far the larger portion of the machinery is operated by the same force, and even the "fun of the fair," including communication with far distant places, is entirely of an electrical character, for while enjoying the exciting wonders of the biograph in the "Fair theater" the patrons are listening to concerts and other amusements going on in theaters all over the New England States and even in Canada by means of innumerable long distance telephone lines.

Prominent among the historic electrical features are the beautiful group of wax tableaux shown by the Eden Musee Company of New York. These tableaux represent the following incidents: A Syrian woman discovering electricity in her amber spindle anterior to the Christian Era; the punishment of a sailor for falsifying a ship's compass in the 12th century; Dr. Gilbert explaining the terrella to Queen Elizabeth, A. D. 1600; Stephen Gray experimenting on the conduction of electricity, A. D. 1720; Dean von Kleist bottling electricity in a Leyden jar, A. D. 1746; Ben Franklin drawing lightning from the clouds in 1752; Galvani's famous frog experiment; Michael Faraday's experiment with the first dynamo-electric machine, A. D. 1831. From the day when the exhibition was opened there has been no time when these realistic figures have not been surrounded by a wondering crowd of spectators.

Another attractive electrical feature is the blowing up of miniature war ships by wireless telegraphy as exhibited at the Electrical Exhibition in New York. Not only does the United Electrical Supply Company of New York City make this exhibit, but it has a complete X-ray outfit that is visited by everybody, an acetylene gas generator, a thermo-electric generator and other up-to-date appliances, the varied and practical uses of which are explained by competent attendants in charge of the various exhibits.

Blodgett Bros. & Co., Boston, exhibit a large and handsome clock with four faces, placed on top of a tall column in the center of the main hall and kept revolving by means of electricity. In their booth the same firm exhibits a full line of clocks for schools, colleges, town halls and other public buildings, all of which are regulated by the electric current. Messrs. Blodgett enjoy what is practically a monopoly of manufacturing and installing public timekeepers having electrical controlling features.

The Buckeye Electric Company of Cleveland, O., has an attractive exhibit of vari-colored incandescent lamps of all voltages and many of artistic form.

The Edison Electric Illuminating Company of Boston makes the most extensive of the electrical exhibits. It covers no less than 2,184 feet of space on the floor of the central hall. It is in the form of a handsome archway, having three aisles, supported by massive columns, the open-work frame being covered with an abundance of long tendrils of smilax fresh gathered every few days, the rich green of which, in contrast with the white-painted columns and rafters, produces a most striking effect. Of the three sections or aisles in this booth, the central one is devoted to ornamental incandescent lighting by means of miniature lamps so arranged as to produce brilliant, interesting and novel effects. In one of the side aisles are exhibited incandescent and arc lamps, showing the most improved and efficient types of lamps, ranging from 8 to 100 CP.; also standard enclosed arc lamps, ranging from 400 to 2,000 CP. There is on display too in this section a "photometer" and a "prepayment meter," operated on the "nickel-in-the-slot" plan, together with many other interesting devices. In the opposite aisle the application of electricity to cooking, baking and various domestic uses are displayed in actual operation. A very powerful searchlight is shown, while printing and other machines are being run by electricity. There are nearly 6,000 lamps used in the Edison exhibit, which is the most crowded place in the entire fair.

The General Electric Company's exhibit consists of a huge globe, representing the earth, 25 feet 4 inches in diameter and mounted on a suitable pedestal (the same was exhibited at the Street Railway Convention). On the surface of this mammoth sphere are shown the exact geographical locations of the various oceans, seas, continents, islands and archipelagos scattered over the globe and drawn to a scale of 312 miles to one foot. Each nationality is indicated by its national flag placed on the country it represents, while at night over 400 diminutive colored incandescent lamps mark the location of representative installations of General Electric plants. Encircling the globe at the equator is a flattened ring forming a railway track on which runs a small electric car which makes the circuit of the earth once in twenty seconds. The interior of the globe is fitted up as a handsome reception room, while the palisading around the entire lot is designed of various sized gear wheels, car controllers, etc. In addition to this handsome exhibit the General Electric Company furnishes the motors and generators which operate the various shoe, printing and other machines as well as lights many of the exhibits.

The Holtzer Cabot Electric Company of Boston has an unusually attractive display of its well-known high grade electrical apparatus. This includes fan motors of rich design, complete telephone systems, dynamos for electroplating, generators for lighting and power purposes, handsome switchboards and a unique array of appliances for domestic uses. Their electrically-operated bandage winder for hospitals and dental machines attract everybody's attention. This is one of the most varied and interesting exhibits of an electrical character there is in the fair.

The Incandescent Electric Lamp Manipulator Company, whose head office is in Boston with factory at Hyde Park, Mass., makes a fine show of its novelty that is taking the users of lamps by storm. It is a very handy device for removing and replacing burnt out or other incandescent lamps in out-of-the way, beyond-the-reach places, as in store windows, the lofty ceilings of theaters, music halls, courts of justice, churches and other public places. A child can use it if necessary because of its simplicity, and lamps can easily be reached from 40 to 50 feet away by means of its extension rod. It is without doubt the cleverest device for the purpose ever invented and is having an enormous sale.

The Jandus Electric Company of Cleveland, O., has a handsome display of enclosed arc lamps for use on direct or alternating currents, for series work, railway work, and on different voltages. These lamps are of various sizes, designs and candle power capacity and are said to be in growing demand everywhere.

The Lombard Water Wheel Governor Company,

Roxbury, Mass., makes a display of its efficient specialty in operation. This governor being made in several sizes is adapted for use in a variety of places, and with the speed recorders, also manufactured by this company, forms a combination of the highest efficiency. This governor is now in general use at all of the great water powers in the country.

The Maxham Electric Third Rail Company has a track laid, equipped with its third rail device, and over this section of track a small car runs in demonstration of the value of this solution of the problem of street car propulsion.

The Moore Electrical Company of Newark, N. J., exhibits Mr. D. McFarlan Moore's system of vacuum tube lighting in a most unique and artistic manner. "Moore's Parlor" is a very attractive spot in the fair. It is crowded every hour of the day. The handsome appointments of the "parlor" are shown to great advantage in the flood of "artificial daylight," which it is claimed is to be the method of interior illumination in the future.

The New England Telephone & Telegraph Company has a number of booths located about the fair buildings in which the public can transmit messages over long distance lines or enjoy the music that is being discoursed in theaters and music halls in far distant cities. A very enjoyable telephonic feature too is the liberal use of a number of instruments by the free use of which anyone can enjoy the continuous performances in Keith's New Theater in Boston.

There is quite a large and varied exhibit of motovehicles, including those run by steam, gasoline, petroleum and electricity. The "Columbia" types attract attention, as do several others made in Waltham, Mass., and elsewhere. The Riker Electric Company, Brooklyn, N. Y., has quite an array of heavy and handsome delivery wagons, tricycles, quadracycles and other vehicles, and the manner in which the attendant demonstrates the safe and handy way of operating any one of them attracts a wondering crowd all day long.

Whitman & Couch, Boston, who are now so well known in the independent telephone field, make an unusually fine exhibit of their apparatus, both complete telephone installations and also the various individual pieces of apparatus.

James L. Russell, Boston, representing some of the best specialties in the electrical field, has a brilliant exhibit of the Nowotny long-burning enclosed arc lamps of artistic design, generators and motors made by the Onondaga Dynamo Company of Syracuse, also a handsome switchboard on which are displayed a variety of instruments made by the S. E. S. Company of Syracuse, N. Y., and a Philbrick mast-arm.

The Ridgeway Dynamo & Engine Company, Ridgeway, N. J., represented by Mr. J. L. Kimball for the New England States, exhibits a 75 KW. dynamo directly connected with one of their high speed engines. With this combination part of the fair is illuminated by arc lights, and the brilliancy and steadiness of this special system make much favorable comment.

The Burton Electric Smelting Company, Boston, shows a complete outfit for melting ores by means of an electric current, and included in the same exhibit is an electric forge at which two men work right along making various articles of iron and steel, also a small electric leather tanning plant, in demonstration of the practical value of these various inventions made by Mr. George D. Burton.

As might be expected at a fair like this there is an extensive display of gas engines, hot air engines, compressed air devices, as well as many types of steam engines, also the Diesel motor, all of them in practical operation running machinery of various kinds. These illustrate the rapid and improved changes which are constantly taking place in the evolution of more efficient and economical power generators, but by far the most striking and attractive exhibits are those in which the electric current is the operating medium. K.

CANADIAN NOTES.

Messrs. Nesbitt, Gauld & Dickson of Hamilton, Ont., are applying to the Ontario Legislature for an act to incorporate the Hamilton & Caledonia Railway Company. The idea of the promoters of the railway is to build an electric line from the city of Hamilton to Caledonia, and to extend it to the village of Selkirk.

The south shore at the Lachine Rapids, Quebec Province, will soon be able to boast of hydraulic works similar to those on the north shore of the Rapids which belong to the Lachine Hydraulic & Power Company. A company has been formed, composed of Canadians and New York capitalists. Work is expected to begin next spring, the promoters of the company intending to study during the coming winter the effect of the frazil ice in the chutes of the Lachine Power Company dam. To create the required fall the new company will have to dam Isle du Diable to the mainland, at the head of the rapids, and lower from the same island to the Isle du Paquette. When once this new water power is created the city of Montreal will then have another electric company to supply its citizens with light and power for manufacturing purposes, with the advantage of several competitive companies to select from.

The largest electric light dynamo in Canada has just been installed in the new power house of the Ottawa Electric Company near the suspension bridge at the Chaudiere Falls. It is of the Westinghouse type with a capacity of some 10,000 lights. The machine is very massive and weighs 23 tons. This dynamo will supply current for the lighting of the Parliament and Departmental buildings of Ottawa.

Exports of Electrical Material from New York.

The following are the exports of electrical material from the port of New York for the week ending November 29:

Brazil—653 packages, $7,002.
British East Indies—147 packages, $4,456.
Bremen—15 cases, $3,000.
British Possessions in Africa—47 cases, $1,805.
Chili—9 cases, $403.
China—28 cases, $1,417.
Hong Kong—26 cases, $968.
Hamburg—102 cases, $11,006.
Liverpool—29 cases, $635.
London—128 cases, $8,900.
Southampton—2 cases, $104.
U. S. of Colombia—3 cases, $1,650.
Venezuela—357 cases, $1,127.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING.

Camden, N. J.—The lighting committee of the city council has decided to readvertise for bids for lighting the city with electric lights because of the withdrawal of the certiorari proceedings against the bid of the Citizens' Light, Heat & Power Company.

Carthage, Mo.—At the special election held here on the 22d ult. to get a public vote on the proposition to authorize the city council to issue $25,000 in bonds for the purpose of building and maintaining an electric light plant, the proposition was carried by a large majority.

Fredericksburg, Va.—The city council has ordered an election for the ratification or rejection of a resolution which passed that body for the erection of an electric light plant at an approximate cost of $11,600.

Forsyth, Ga.—The vote here at the special election to decide the question of bonding the town to put in an electric light plant was 109 for to 27 against, which means the erection of a plant at an early day.

Herkimer, N. Y.—"Two weeks ago," says the Herkimer "Citizen" of the 29th ult., "the municipal commission awarded the contract for the construction of the incandescent electric system to the Westinghouse Company of Pittsburg for $10,500, and a contract according to the agreement made with the agents was sent to the company to sign. It was held until the 26th inst. and returned with the clause stricken out providing a forfeiture of $25 per day for failure to complete the work within the specified time of sixty days, which was the time named by the company. Village Attorney Steele advised the commission against accepting the revised contract and it was rejected. The commission are justly indignant at the action of the company."

Johnstown, N. Y.—General W. F. Lansing has made application to the council for a franchise "authorizing the introduction of electric power for lighting, heating," etc., in this city.

Little Falls, Minn.—The council has passed a resolution offering to purchase the local water and electric plant from the company for $45,000, the proposition to be good until December 20.

Newark, N. J.—The People's Electric Light & Power Company of this city has issued a circular to its out-of-town patrons and prospective consumers of current. The company recently made a cut in the rates for domestic service and the reduction proffered in the new circular amounts to from 7½ to 13½ per cent. upon the present prices. This reduction will cover all territory comprised in Jersey City, Bayonne, Irvington, Clinton, Vailsburg, Orange, East Orange, West Orange, South Orange, Bloomfield, Montclair, Caldwell, Verona, Harrison and Kearny, and will be from the schedule of prices as now charged in the different towns to a uniform rate of 13 cents per kilowatt for current, not including lamp renewals.

New Orleans.—The Crescent City Electric Light Company, which proposes to erect an electric plant in this city for lighting and power purposes, has been formally organized. The following officers have been elected: President, Joseph H. DeGrange; secretary-treasurer, Sidney H. March; general manager, J. B. Craven; attorney, E. D. Saunders. Among the leading men interested in the undertaking as stockholders are Isidore Newman, S. Gumbel, Isidore Hechinger, H. R. Gogrieve, William Oswald, Alfred Hiller, Paul Godchaux, Sidney White and J. W. Murphy. The company is organized under the grant given by the council in the name of T. M. Miller.

Norfolk, Va.—The entire city of Norfolk was plunged in total darkness on the night of the 30th ult. by the blowing out of a valve on the main engine at the Virginia Electric Light Works.

Richmond, Ky.—An electric light plant will be established here at once by B. F. Adair and others who have purchased a site for the power house. The company hopes to turn on lights within ninety days.

Rochester, N. Y.—Mayor Warner is an earnest advocate of municipal lighting and is preparing a communication on the subject which he intends to present to the council. The present contract for lighting the city is held by the Rochester Gas & Electric Company. It was executed in the summer of 1897 for a period of five years. That leaves it about three and one-half years yet to run.

Tupper Lake, N. Y.—The Tupper Lake "Herald" says: "A gentleman from Utica representing an electric light plant has been in town the past week considering the feasibility of establishing such an industry in our town. We understand that the result has been very gratifying and that he has practically decided to put in the system, a large number of lights having been guaranteed."

Watervliet, N. Y.—The electric light board has decided on lighting all the public buildings with electricity. The following members were appointed to look after the wiring: Aldermen Bridgman, Baxter and Mitchell.

STREET RAILWAYS.

Albany, N. Y.—It is only a matter of a short time when a continuous chain of electric railways will extend from Albany to Saratoga. The latest link in the chain is the proposed line from Schuylerville to Greenwich, which is already under way. It will be five miles long and will pass through Clark's Mills and Middle Falls. Joseph A. Powers, who is president of the Stillwater & Mechanicville Electric Railway, is one of the prime movers in the new road.

Astoria, Ore.—The city council has granted to F. D. Kuettner a street railway franchise covering all the streets in the city for 75 years. The franchise provides that Mr. Kuettner must acquire the present street-car system within one year.

Chicago.—The Sprague multiple unit system is now in successful operation on the South Side Elevated road and is receiving favorable notice from the press. The fundamental principle of the system is that each car has its own motive power, its own lighting and heating plant and is entirely independent of the rest of the train.

Flint, Mich.—Another electric railway project for a road between Flint and Long Lake, distance 18 miles, is announced. R. M. Luton of Grand Rapids is the promoter.

Harrison, N. Y.—The Port Chester Electric Railway Company has been unsuccessful in getting the consent of the requisite number of property holders along its proposed route on Halstead, Rye Beach and Harrison avenues, and has applied to the Appellate Division of the Supreme Court to appoint a commission to decide on the necessity of building the line.

Harrisburg, Pa.—Twenty-five per cent. of the entire capital stock of the street railways of Pennsylvania operating their own or other lines is that issued by the Consolidated Traction Company of Allegheny county. The total amount of capital stock outstanding of the ninety-four street railway companies in the State operating their own and other lines is $100,909,335. In addition to the amount of capital stock outstanding by

lessor companies there is $56,027,922, the capital stock outstanding of the corporations whose lines are owned or operated by lessor corporations. The figures are taken from the advance sheets of the annual report of Major Isaac B. Brown, Chief of the State Bureau of Railways, for the fiscal year ended June 30 last. Major Brown recommends that the provisions of the constitution which prohibit fictitious capitalization should be strongly enforced, and declares that this can only be done by additional legislation empowering the officials of the Commonwealth to exercise greater supervision over these corporations. He says further that when it is found that many of the roads are capitalized at three or four times of the probable cost it is not difficult to discover the system of financiering that has characterized their management.

Kansas City, Mo.—A number of prominent contractors of the country have been invited to submit bids for the construction of the Northeast Electric Street Railroad, the necessary specifications for the estimates having been sent to them. The bids are to be opened within 30 days at the company's office in Kansas City, and the work awarded. One of the specifications is that the reconstruction of the road must be commenced at once and be completed within four months.

Key West, Fla.—The board of aldermen has granted a street car and lighting franchise to the Messrs. Laflin, who are the principal owners in the Key West Electric Company which has just absorbed the Key West Gas & Electric Company.

Los Angeles, Cal.—T. E. Gibbon and William S. Hook have petitioned the council to advertise for sale a franchise for a double track electric street railway on Santa Fe avenue and other streets in this city.

Metuchen, N. J.—The Plainfield & Metuchen Street Railway Company has secured rights of way over a large portion of the route proposed for its trolley road between Plainfield and Metuchen and expects to begin work on the road early in the spring.

New York.—The snow storm last week hindered work on the conduits now being laid in miles of the city streets by the street railway companies, but gangs of men were kept busy shoveling out the snow and the mud from the trenches and enabled the workers on the conduit construction to resume their operations as soon as the storm was over.—The car house of the Union Railway Company at Boston avenue and Woodruff street was totally destroyed by fire on Wednesday last. Seventy-five cars in the building were also destroyed together with a lot of electrical machinery, and the total damage is estimated at $150,000. The insurance on the property is $100,000.

Philadelphia.—The Central Electric Railway Company of Philadelphia and Delaware counties has taken preliminary steps to erect a network of trolley lines through Delaware County towns. The lines will reach Yeadon, Cardington, Llanerch, Lansdowne, Marple township, Media, Wallingford and Clifton Heights. They will connect with the Delaware county road and the Chester and Media Railway.

Providence, R. I.—The Providence & Greenwich Electric Traction Association has completed its organization. The Association proposes to build an electric railway between this city and East Greenwich.

South Bend, Ind.—The street car lines in this city, on which there was no service for four months, are running again, having been entirely rebuilt and re-equipped at an expense of $200,000. As soon as the weather will permit work will begin on lines connecting South Bend with Niles, Mich., and Goshen and Elkhart, Ind., making with the present lines forty-six miles of electric street railway. The present city and suburban lines cover fifteen miles.

West Chester, Pa.—The tracks of the Philadelphia, Castle Rock & West Chester Railway reached this place on the 29th ult., and cars will be running over the line in a few days. This railway commences at Sixty-second and Market streets, Philadelphia, and terminates in West Chester, the length being twenty-two miles.

MANUFACTURING, ETC.

Springfield, Ill.—The Westinghouse Electric & Manufacturing Company has been licensed for business in Illinois with a capital of $29,000.

Toledo, O.—The firm of W. G. Nagel & Co. has been organized for the purpose of conducting a general business in electrical machinery, supplies and construction in Toledo.

Troy, N. Y.—The E. G. Bernard Company of this city has closed another contract with the United States Government. This company will install an electric lighting and ventilating plant in the Coast Survey steamer Blue, Captain Wainwright commanding. This vessel is now being fitted at Baltimore for a trip to Porto Rico.

Washington, D. C.—In his annual report Consul Roosevelt of Brussels says: "The employment of electricity for illuminating purposes is rapidly extending in this city. The lamps as well as nearly all other electrical supplies here are of German origin; Holland supplies a few and England a fair percentage of the electrical wires employed. American lamps and other electrical goods are exposed for sale on this market, and are conceded to be superior to those imported from Germany, France and England, and with proper effort the trade in this line could be greatly increased. Especially in copper wire, insulated wire, large cables and arc lamps is there an excellent opening."

POWER AND TRANSMISSION PLANTS.

Buffalo, N. Y.—The Buffalo Railway Company has for some time been using electric current from Niagara Falls to run its cars, and now the lighting company is using the same power in its lighting service. In this case Niagara Falls electricity is not applied directly to the lamps. The electric light company uses the power in a motor which operates a dynamo, which, in turn, generates the electricity for the lights. As soon as the new power plant of the company is finished all the city lamps will be lighted with the aid of the new power.

Cleveland, O.—One of the heaviest applications of electric power to machine tools is an angle iron cutting machine designed for one of the largest iron companies. An electric motor is directly geared to the shearing machine, which is capable of cutting bars up to 8 inches by 1 inch thick and this, too, without destroying or distorting the piece cut off.

Wrightsville, Pa.—The Susquehanna & Tidewater Canal is to be opened next year for service and the boats will be propelled by electricity from a plant now in course of construction at Wrightsville, where the Martic Water & Power Company are building a dam and preparing to erect a power house in which machinery capable of generating 4,000 horse power will be installed. The canal extends from Wrightsville to Havre de Grace. The officers of the Martic Water & Power Company are: President and chief engineer, James H. Harlow; treasurer, George K. McGaw of Baltimore, Md.; secretary, Stephen J. Caldwell of Cecil County, Md.

MINES, ETC.

Cumberland, Md.—The Cumberland & Elk Lick Coal Company has just put in an electric generator of ponderous proportions which pulls twenty or more loaded mine cars on a trip. The mine has also in successful operation an electric pump which keeps the mine clear of water. The Merchants' Coal Company, operating in the Elk Lick region, has an electric plant which is a model in every detail. It is principally used in undermining the coal. The apparatus consists of a motor stationed on a sliding carriage and propels an endless chain, upon which are a number of steel claws, not unlike the teeth of a large circular saw. The machine is stanchly braced up against the breast of the coal and the current turned on. The chain begins to revolve rapidly and the claws are forced into the coal, cutting clear and clean 42 inches wide to a depth of seven feet under the coal in a few minutes. This operation is repeated until the full width of the breast is undermined. The machine is then loaded upon a truck, requiring but a few minutes, and is removed to another room. The miners of the room that has been undermined "put in a shot" and discharge it, knocking down the entire breast of coal. As high as eleven cars of coal have been loaded from one shot.

Denver, Col.—The Colorado Springs correspondent of the Denver "Republican" writes: "D. V. Donaldson has recently returned from camp, where he has been in the interests of the Colorado Electric Power Company, and brings back a flattering report of the way in which electricity is revolutionizing the mining methods of the camp. Among the new properties that have taken power is the Las Mobile Company, which has put a No. 3 hoist on the Last Chance to work the recent strike on that property. The Findley has put in power on the Randall lease. The Lake City Mining Company on the Wisconsin, the Mary Anne on Raven hill and the Badger Boy have put in plants within a week. Taken altogether, Mr. Donaldson is greatly pleased with the outlook and says that electricity is already revolutionizing methods at camp."

COMPANY MATTERS.

Clyde, N. Y.—The Clyde Gas & Electric Company of Clyde has bonded its entire plant for $25,000 and to secure the bonds has put a blanket mortgage on the plant for $25,000 to the Trust & Deposit Company of Syracuse.

Cincinnati.—The machinists of the Bullock Electrical Manufacturing Company, of Norwood, about 500 in number, have again gone on strike. The trouble started several months ago, the company having introduced the piece-work system, to which the men object. It then resulted in a strike. The company, however, agreed that the men should be restored and that they would not be put on piece-work, but the men claim that the company has failed to live up to its agreement.

New Haven, Conn.—A charter is to be applied for before the next Legislature for a trolley road from Southington to Waterbury, a distance of about ten miles. The new line will be a parallel of the Waterbury, Meriden & Connecticut River Road soon to be reopened. The trolley line between Stratford and Milford is soon to be double-tracked.

Philadelphia.—The Technic Electrical Works, a corporation under the laws of New Jersey, made an assignment on the 1st inst. for the benefit of creditors to Richard L. Binder.

Springfield, Mass.—A meeting of the stockholders of the Northampton-Amherst Street Railway Company was held in this city last week. The purpose of the meeting was to call in 10 per cent. of the capital stock, and to push the matter of application for a charter as an incorporated company, and to fix other details of organization.

PERSONAL AND MISCELLANEA.

On the night of the 29th ult. at Scranton, Pa., Charles Asperschlager, engineer at the Dickson Manufacturing Company's Cliff Works, while using an iron rod to turn the switch of an arc lamp was instantly killed by an electric shock. He was standing on an iron rail when trying to move the switch with the rod. He was 30 years old.

The Detroit "Journal" says of A. B. Du Pont, general manager of the Citizens' Street Railway, Detroit, that "he is an authority on electric roads and their practical management, and is credited with being able to make the electric current and transmit it over the wires at less cost than any other man in this part of the country."

General Manager Charles R. Huntley of the Buffalo General Electric Company is reported to have been cured of pneumonia by electricity and without the aid of any medicine. When the doctors pronounced Mr. Huntley's disease pneumonia he got an electrotherm or electric heating pad, which looked like a big rubber plaster. It was eleven inches wide, fifteen inches long and less than half an inch thick, and Mr. Huntley's description of its application as given in the Buffalo papers is as follows: "Attached to the pad was an insulated conducting cord fifteen feet long, with a regular switch and a plug. The nurse attached the end of the cord to an incandescent lamp socket and turned on the current. The mat or rubber plaster was laid on Mr. Huntley's chest and kept there for a week. A thermostat was attached to it, cutting off the current after it got beyond a certain heat, prescribed by the doctors. Three degrees of heat were possible: One, 120, another 140, and the third 160. Within ten days Mr. Huntley was up and about the house and on the tenth day he was out attending to business as usual and shows not a sign of a struggle with pneumonia. The life saving mat he used is composed of asbestos insulated wires woven into a flexible mat or pad, which, when attached to the ordinary incandescent lamp socket affords sufficient resistance to the electric current to produce a constant and uniform degree of heat. It is of value as a substitute for hot-water bags and other bothersome methods of applying and maintaining artificial heat in local applications. It is simply devised and cannot burn the patient. It is made from any voltage from 5 to 125 and can be used with either direct or alternating current. The switch regulates the temperature to any required degree, preventing the possibility of accidental overheating. The thermostat or temperature regulator is incorporated in the mat and automatically interrupts the current and operates to keep the temperature within the prescribed limit."

RECENT COMPANY ELECTIONS.

Anacostia Street Railway Company, Washington, D. C.—President, F. C. Stevens; directors: F. C. Stevens, H. D. Mirick, Oscar T. Crosby, C. A. Leib and Messrs. Minor and Griswold. The two latter are the receivers of the road.

Dayton & Xenia Traction Company, Dayton, O.—President, Levi Weiskopf; treasurer, Alfred Hill, both of Cincinnati.

West End Street Railway Company, Boston.—Directors: G. T. W. Braman, Richard M. Saltonstall, Parkman Dexter, Walter S Swan, Albert C. Houghton, C. Minot Weld, Samuel Little, Stephen W. Weld, Joseph B. Russell, Chas. A. Williams, Samuel Spencer, Moses Williams, Alfred Winsor. Messrs. Parkman Dexter, C. Minot Weld and Charles A. Williams succeed T. Jefferson Coolidge, William Hooper and Henry D. Hyde.

COMMERCIAL PARAGRAPHS.

The Electric Appliance Company, Chicago, report that they are meeting with splendid success with the 98 Model Packard Transformer and that it is more than fulfilling all the claims and guarantees that they have made.

Brass Socket Causes Death.

Pass & Seymour, Syracuse, N. Y., have received a letter from R. I. Holding, Salt Lake City, Utah, stating that Louis Kayazer, an engineer at the Seattle Steam Laundry, was killed by an electric shock received while he was changing a small globe from one socket to another, his hand coming in contact with the socket. Mr. Holding in his letter says: "This is a strong recommendation in favor of your porcelain socket, for had they been in use in this instance one man would not have been called to an untimely end."

"Peerless" Secures First Prize.

Some time since the Warren Electric & Specialty Company, manufacturers of incandescent lamps, Warren, O., organized a contest for a choice of name for their new lamp. The judges have just rendered their decision, and the following is a list of those persons who were awarded prizes:

First prize, $50, "Peerless."—Joe E. Calloway, Pueblo, Colo.; Jno. C. Watson, Charlotte, N. C.; J. W. Freeman, Joplin, Mo.

Second prize, $30, "Wesco."—K. W. Mansfield, South Norwalk, Ct.; Gugler Electric Company, Minneapolis, Minn.; J. E. Calloway, Pueblo, Colo.; H. P. Ayer, Portland, Me.; J. S. Daily, Chillicothe, Ill.; New Orleans Electric Company, New Orleans, La.; C. J. Wetsel, Chicopee Falls, Mass.

Third prize, $20, "Liberty."—W. H. Schott, Chicago, Ill.; Joe E. Calloway, Pueblo, Colo.; A. D. Scatcherd, Batavia,

N. Y.; Chas. Frankish, Ontario, Cal.; Phillip Hickley, Chicago, Ill.

Fourth prize, $10, "Aladdin," "Aurora," "Eclipse," "Encore."—Thos. Day Co., San Francisco, Cal.; D. A. Gill, Kansas City, Mo.; Lemuel K. Cushing, Chicago, Ill.; H. L. Brintnall, Saginaw E. S., Mich.

INCORPORATIONS.

The Delaware Electric Light & Power Company (incorporated at Albany, N. Y.). Authorized capital, $250,000. Incorporators: P. G. Stappens, D. McM. Niven, C. W. Phillips, New York City.

The Carter-Hays Electric Company, Louisville, Ky.—to manufacture, repair, buy and sell electrical appliances. Capital stock, $5,000. Incorporators: L. D. Carter, E. W. Hays and H. O. Hays, Louisville.

The Pacific Trading Company, Tacoma, Wash.—to erect and run factories, build and operate telegraph and telephone lines, power plants, etc. Incorporators: J. W. Garbin, F. H. Chandler and C. McDaniels.

The Red Lake Electric Light Company, Red Lake, Minn. Capital stock, $8,000. Incorporators: Marcus Johnson of Atwater, Anna F. Marshall and L. R. Simons of Red Lake Falls.

The Acme Electric Lamp Company, New Brunswick, N. J.—to manufacture lamps, etc. Capital stock, $500,000, of which $200,000 is preferred. Incorporators: Louis A. Jackson of New York, Ralph W. Booth, Sr., and Ralph W. Booth, Jr. A plant will be erected in New Brunswick.

The Vicksburg Electrical Supply Company, Vicksburg, Miss.—to manufacture and deal in electrical supplies, etc. Capital stock, $10,000, with privilege of increasing to $250,000. Incorporators: M. J. Mulvihill, S. R. Hughes and M. D. Landau.

The Rockford Electric Lighting Company, Rockford, Ill. Capital stock, $6,000. Incorporators: C. S. Mauk, A. G. Stewart, D. O. Kuder, F. M. Kirby, J. D. Wagers and W. T. Palmer.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED NOVEMBER 29, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

614,875. Trolley for Electric Cars. Hosea W. Libbey, Boston, Mass. Filed Jan. 11, 1898.

614,941. Trolley Device. James C. Fernald, Philadelphia, Pa., assignor to Joseph A. Smith and John H. Canavan, same place. Filed April 19, 1898.

615,176. Electric Railway. Hermann T. Hillischer, Vienna, Austria-Hungary. Filed July 8, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

614,914. Mechanism for Controlling Electric Circuits. George H. Whittingham, Baltimore, Md. Filed April 5, 1898.

614,927. Process of and Apparatus for Separating Metals and By-Products from Ores by Electricity. George D. Burton, Boston, Mass. Filed Jan. 25, 1897.

614,930. Process of and Apparatus for Separating Metals from Ores by Electricity. George D. Burton, Boston, Mass. Original application filed Jan. 25, 1897. Divided and this application filed April 11, 1898.

614,964. Dynamo-Electric Machinery. Joseph S. Lewis and Felix J. Howitt, Manchester, England, assignors to the P. R. Jackson & Company, Limited, same place. Filed April 12, 1898.

TELEPHONE AND TELEGRAPH APPARATUS.

614,946. Telephonic Microphone. William D. Gharky, Philadelphia, Pa., assignor to George F. Payne, same place. Filed Dec. 20, 1897.

MISCELLANEOUS.

614,839. Method of Forming Electrical Connections. William B. Cleveland, Cleveland, O. Filed May 9, 1898.

614,882. Junction-Box. Thomas J. Murphy, New York City. Filed April 22, 1895. Renewed Dec. 31, 1897.

614,928. Process of Tempering Metal. George D. Burton, Boston, Mass. Filed March 13, 1897.

614,929. Process of Tanning Hides or Skins of Animals. George D. Burton, Boston, Mass., assignor to the United States Electrical Leather Process Company of Maine. Filed April 5, 1898.

614,982. Automatic Time Electric-Circuit Switch. Frederic Richard, Boston, Mass., assignor to the Universal Electric Clock Company, same place. Filed Oct. 30, 1897.

614,995. Underground Conduit for Electrical Conductors. Charles H. Sewall, Chicago, Ill. Filed March 2, 1898.

615,057. Electromechanical Striking Mechanism. Clarence E. Beach and Herman W. Doughty, Binghamton, N. Y., assignors to the Star Electric Company of New York. Filed Sept. 8, 1896.

615,136. Electric Metal-Heating Process. George D. Burton, Boston, Mass. Filed Aug. 21, 1893.

615,142. Signaling. John P. Coleman, Edgewood Park, Pa., assignor to the Union Switch & Signal Company, Swissvale, Pa. Filed Jan. 3, 1898.

615,172. Primary Battery. Henry K. Hess, Philadelphia, Pa. Filed Feb. 2, 1898.

615,188. Electric Safety Device. John F. Kelly, Pittsfield, Mass. Filed April 14, 1898.

615,209. Electrical Hinge-Contact. Channing Baxter, New York City, assignor to Albert S. De Veau, Mount Vernon, N. Y. Filed Nov. 21, 1895. Renewed Jan. 17, 1898.

DESIGN.

29,741. Third-Rail Insulator. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Nov. 7, 1898.

TELEPHONE AND TELEGRAPH.

Canvassing for the New Telephone Company in New York.

The People's Telephone Corporation of New York is meeting with immediate success in getting subscribers in the Borough of Manhattan, the canvassers having in a few days obtained the names of 6 000 or 7,000 telephone users. In fact nearly every business man who has been called on has cheerfully added his name to the fast increasing list, apparently glad of the opportunity to help along a movement that promises telephone service at reasonable rates as compared with the exorbitant charges of the New York Telephone Company. The inducements offered by the new company in its published circular are:

1. A superior system, rapid service, new instruments and first-class modern equipment throughout.
2. A reduction from $240 to $100 for unlimited service, with 100 coupons *free*, good at any pay station.
3. A reduction from $90 for 600 calls to $40 for 400 calls, with additional calls as low as 4 cents each.
4. An arrangement with message service subscribers by which they receive a liberal division of pay station tolls.
5. Private exchanges of 5 or more instruments at a rate message as low as 2 cents per call.
6. A private line residence service as low as $30 per year.
7. A group-line residence service, unlimited calls, at $1 per month.
8. No charge for service until 10,000 subscribers are connected.
9. A rebate for all interruptions exceeding 48 hours.
10. We are willing to guarantee above prices for 5 years, and permit cancellation without liability on most liberal conditions.

The councils' electrical committee, Philadelphia, on the 1st inst. agreed to report favorably to councils the ordinance to amend the ordinance granting privileges to the Standard Telephone Company. The principal "amendments" to the bill, which was assumed to have become defunct through failure to comply with its provisions within the specified time, give the company the right to erect wires "over and across" the streets of the city, to purchase or lease conduits belonging to the city or other corporations, to mortgage its property and franchises to secure its bonds, and extending to four years the time in which it must be prepared to furnish 2,000 telephones to subscribers. Regarding the proposed amendments, City Solicitor Kinsey, at the request of the committee, gave an opinion, in which he says that to extend the time as proposed "would substantially effect the release of the company from the $100,000 penalty incurred by having heretofore broken a condition of its bond."

On the 28th ult. the committee on public improvements of the Boston Board of Aldermen reported favorably the petition of the new Massachusetts Telephone & Telegraph Company for the right to enter certain streets in Boston and to operate and maintain a system of conduits, etc., in connection with their telephone system. On the same day a motion was made in the board of aldermen to suspend the rules that the order might be placed upon its passage, but the motion was defeated and the order went over under the rules. The petition, however, is likely to be granted. The incorporators of the company are: Zephaniah S. Holbrook of Cambridge, Wilbur F. Lakin of Quincy, Fred A. Spear of Lowell, Paul Faver of Boston and Silas P. Chase of Reading, Mass.

The Memphis *Scimiter* says litigation against the Cumberland Telephone & Telegraph Company in Memphis is piling up from day to day. The aim in all or nearly all the cases is to reduce the cost of telephone service in Memphis, on the ground, primarily, that lower rates are being given by the company in other parts of the State. On the 28th ult. a bill was filed in the Circuit Court the object of which is to secure damages from the company on the ground, as alleged, of illegal discrimination, under the statute which directs that there shall be no discrimination, and that the company shall in case of such discrimination forfeit $100 per day to the person so discriminated against. The complainants are Ralph Wormley & Co., Louis Woods, Peter Anderson and the Woods-Chickasaw Manufacturing Co.

A telephone company in which Armour, Swift and Nelson Morris are interested has been incorporated to build and operate an independent telegraph and telephone line to connect all their packing houses in the West with their Chicago houses. The proposed line is to connect East St. Louis, Omaha, Sioux City, St. Joseph and Kansas City. The company, which will use the Schomberg system, is offering for sale $500,000 of gold bonds. It will transact a general telegraph and telephone business.

A meeting of independent telephone men was held recently at Glasgow, Mo. The meeting was called by W. N. Wicks, president of the Glasgow system, and the object as stated, was "for mutual protection and development of the interests of all local independent and co-operative telephone companies in Missouri." About twenty-two exchanges were represented, including one from St. Louis. After discussing various plans for combining the systems, the members adjourned to meet at St. Louis on December 27, and in the meantime each independent exchange will be communicated with and invited to send a representative for the purpose of forming a permanent organization.

Attorney Oscar T. Martin on behalf of I. Ward Freye, Charles H. Pierce, E. C. Guin, Robert Gotwald and Robert Mills of Springfield, O., and others, on the 1st inst. applied to the board of public affairs of Springfield for a franchise for a telephone system in that city controlled by a local company with a capital of $50,000, to be known as the Springfield Union Telephone Company. The Central Union Telephone Company, already operating an exchange in Springfield, is offering strong opposition to the new concern, and has asked for permission to put in a conduit underground system.

The telephone fight in Windsor, Can., which lasted for several months, has ended in a victory for the Bell company, to whom the council has granted a five years exclusive franchise. The terms of the franchise are: For business offices, for local service, $25, residence $20, with Detroit service $15 extra. No extra charge is made for Detroit service for residences if the subscriber has Detroit connections at his business office. In consideration for the exclusive right, the city receives from the company $500 annually and the use of three 'phones free.

The Kansas Telephone & Electrical Company is building a line into Cherryvale, Kan., and will establish an exchange there connecting with over forty other towns and cities, including the lead and coal district of eastern Kansas and southwest Missouri, Pittsburg, Joplin, Fort Scott, Carthage, Webb City, Galena, etc. The company is composed of St. Louis people who have ample capital.

The New Orleans *Picayune* says: "By the 1st of January or thereabouts, the people of New Orleans will be able to talk by 'phone to the people of St. Louis. It is just within the bounds of a possibility, too, that by that time there will be some lightning like changes brought about in the local 'phone world, changes which may involve the absorption of various local 'phone interests."

The Worcester County Telephone Company is being organized at Snow Hill, Md., by Dr. George W. Bishop, Clayton J. Purnell, John P. Moore, Thomas M. Purnell, and others.

New Companies Incorporated.

The Rocket River Telephone Company, Potsdam, N. Y. Capital stock, $6,000. Incorporators: J. A. Crawford, M. S. Crawford and Fred C. Ward.

The Ohio County Telephone Company has filed articles of incorporation at Frankfort, Ky. Capital stock, $500. Incorporators: J. F. Cooper, T. J. Smith and C. C. Baird.

The Citizens' Telephone Company, West Unity, Ohio Capital stock, $5,000. Incorporators: James H. Miller, Leland B. Kent, Leon P. Charpist, Charles L. Arnold, W. M. Denman.

The Manhattan Microphone Company, Jersey City, N. J.—to make, buy and deal in microphones, telephones, etc. Capital stock, $100,000. Incorporators: John H. Maugham, Yonkers, N. Y.; Theodore J. Mitchell, New York City; Thomas A. Hutchins, Englewood, N. J.

The St. Peter Telephone Company, St. Peter, Minn.—to construct and operate a telephone exchange and telephone lines in St. Peter. Authorized capital, $10,000. Incorporators: H. P. Proctor, Augustus Proctor, Frank A. Chase, J. H. Chase, Viroqua, Wis.; Walter S. Proctor, St. Peter.

The Isle of Wight Telephone & Telegraph Company, Smithfield, Va.—to do a general telephone and telegraph business. Authorized capital, $5,000. Incorporators: J. W. Thomas, J. W. Holloway, W. D. Folk, L. C. Brock, C. S. Betts, J. C. Goodrich, W. J. Edwards, Smithfield; J. U. Burgess, W. N. McAuge, Suffolk, Va.

The Massies Mills Telephone Company, Massies Mills, Nelson county, Va.—to do a telephone and telegraph business. Authorized capital, $2,000. Incorporators: W. D. Meeks, James Dickie, J. C. Bentz, M. B. Hughes, E. P. Parsons, W. H. Miller, Massies Mills; A. G. Bryant, W. M. Boyd, Bryant; R. K. Anderson, Roseland.

The New Rochelle & Westchester Telephone Company, New Rochelle, N. Y.—to operate in New York, Massachusetts, Connecticut and Rhode Island. Capital stock, $150,000. Directors: George W. Sutton and Joseph Claudet, of New Rochelle; Hennett Meyer, of New York; H. A. Conner and F. R. Kellogg, of Brooklyn, and J. H. Scofield and D. G. Whiting of Grand View, N. Y.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Albany, N. Y.—Dec 5:						
Albany Ry. Co	100	2,000,000	$1,750,000	1½ % Q., Aug. '98.	151	158
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug., 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Dec 5:						
Allentown & Lehigh Val. Trac. Co.	.	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Dec 5:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Dec 5:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98.	72¼	78
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	27⅛	27¼
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	...	..
Boston, Mass.—Dec 5:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	18¼	18¾
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	10	12
North Shore Traction Co.......pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	75	77
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	88	89
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	110	110½
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	78⅛	..
Brooklyn N. Y.—Dec 5:						
Brooklyn City & Newtown Ry	100	2,000,000	1,928,400	2 % Feb. 1, 1898.	210	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	68¾	68⅞
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	281½	286
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	..	275
Kings County Elevated	....	4,750,000	4,750,000	....	2¾	4
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	48	..
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	70	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Dec 5:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	60	66
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	78	79½
Columbus O.—Dec 5:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Aug., '98.	59	61
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Dec 5:						
Charleston City Ry. Co	50	100,000	100,000	8 % S., Jan., '98.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Dec 5:						
Chicago City Ry. Co	100	12,000,000	12,000,000	8 % Q.	800	805
Chicago & South Side R. T. RR	100	10,828,800	10,823,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	14¾	15
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	4
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	8 % Q., Oct., 98.	.80	232
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,608,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	18,189,000	1½ % Q., Nov. 98	103½	104
jChicago West Div. Ry.......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Dec 5:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	..
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	...	80¼
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118¾	119¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Dec 5:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	40	42
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	77	78½
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98.	79	80
Detroit, Mich.—Dec 5:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '98.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Dec 5:						
City Railway Co..............com.	100	1,500,000	1,470,000	1¼ % Q., Jan. 1, '98.	108½	109
City Railway Co................pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	157
People's Street Railway	....	1,100,000	....	....	105	..

*Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock.		Rate and Date of Last Div.	Bid.	Asked.
		Authorz'd	Issued.			
Hartford Conn.—Dec 5:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	..
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	..
Holyoke Mass.—Dec 5:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	185	200
Hoboken, N. J.—Dec 5:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	105	..
Indianapolis, Ind—Dec 5:						
**Citizens' Passenger Ry	....	5,000,000	5,000,000	....	26⅛	28
Lancaster, Pa.—Dec 5:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	..
Lancaster & Col. Electric Ry	....	....	87,500	....	..	..
West End Street Railway	....	....	....	....	..	..
Louisville, Ky.—Dec 5:						
Louisville Ry..................com.	100	4,000,000	8,500,000	1¼ %., Oct., '97.	42	42¼
Louisville Ry...................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	105	105½
Minneapolis, Minn.—Dec 5:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000		28	31
Twin City Rapid Transit...7 % pfd.		8,000,000	1,714,200	1¾ % Jan., '98.	101	108
Montreal, Canada.—Dec 5:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	278	279
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	105¼	105¾
Memphis, Tenn.—Dec 5:						
Memphis Street Railway Co	100	500,000	500,000	....	15	..
New Haven, Conn.—Dec 5:						
Fair Haven & Westville RR	25	1,500,000	900,000	8 % S., Sept. '98.	80	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	..
Winchester Avenue RR	25	1,000,000	600,000	....	45	..
New Orleans, La.—Dec 5:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	152	200
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1¼ % Q., Jan., 98.	122	127
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	1⅛	8¾
New Orleans Traction Co........pfd.	100	2,500,000	2,500,000	....	8	10
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	18	21
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	..	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	25	27
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	54	58
New York—Dec 5:						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98.	180	198
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¾ % Q., Oct., 98.	185¼	186
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	33½	37
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	228	227
gCen. Park, N.&E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	180	183
hEighth Avenue RR	100	1,000,000	1,000,000	....	348	355
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	370
jNinth Avenue RR.........guar.	100	800,000	800,000	....	160	180
kSixth Avenue RR.............guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	385	420
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	178	180
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. '98.	156	160
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	74	74½
*Union (Huckleberry) Ry	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Dec 5:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	51½	52
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¼ % A.	195	205
Pittsburg, Pa.—Dec 5:						
Allegheny Traction Co	50	500,000	500,000	....	..	...
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '96.	20¼	20⅝
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	8 %. May, '97.	65½	...
pCentral Traction Co	50	1,500,000	‖900,000	1½ % Nov. 7, '98.	..	...
qCitizens' Traction Co	50	8,000,000	‡8,000,000	6 % A.	68	...
rDuquesne Traction Co	50	8,000,000	‡8,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	8½ %, Nov. 7, '98.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	..	26
Pgh., Allegheny & Man. Trac. Co	50	8,000,000	‖2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry	25	8,000,000	8,000,000	½ %, Jan., '96.	25⅛	25½
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value o stock

q Leased to Fort Pitt Traction Company for 6 % on $8,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October,

s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Dec 5						
Union Street Railway Co	100	$350,000	$350,900	2 %, Feb. '98.	...	150
Northampton, Mass—Dec 5						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Dec 5.						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Dec 5:						
aterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Dec 5:						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	69⅛	71
Philadelphia.—Dec 5:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	42	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98.	68	..
*a*Fairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3 % Feb. 1, '98.	66	..
Union Traction Co............ $12½ pd	50	30,000,000	29,930,450	....	29¼	29⅜
*c*Electric Traction Co	50	....	8,297,920	....	..	...
*d*Citizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	330	..
*e*Frankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	405	..
*f*Lehigh Avenue Ry. Co	50	1,000,000	....	....	43	...
*f*Lombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
*d*Second & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	275	...
*c*People's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
*g*Germantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135	138¼
*g*Green & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	185½	..
*h*People's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
*h*People's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
*i*Philadelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh., Oct. 98.	91⅛	94⅛
*j*Catherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
*j*Continental Pass. Ry.....guar..	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
*j*Philadelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	170	180
*j*Philadelphia & Gray's Fy. RR..	50	1,000,000	298,650	$3.50 share July '98	90	..
*j*Ridge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	295	300
*j*Philadelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
*j*17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
*j*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖335,000	$11 sh. A., July, '98	270	..
*j*Union Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	228	..
*j*West Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	235	250
Rochester, N. Y.—Dec 5:						
Rochester Railway Co	100	5,000,000	5,000,000	....	13	15
Reading, Pa.—Dec 5:						
*j*Reading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
*k*City Passenger Ry	50	350,000	850,000	Jan., '98.	114	...
*l*East Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Dec 5:						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct., '98.	151	155
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	..	....
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '98.	90	110
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % Oct., '98.	178	180
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry............com.	50	500,000	500,000	....	53	60
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	120	122
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	58	60
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	..	175
San Francisco, Cal.—Dec.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	109	...
Geary Street Park & Ocean RR	100	1,000,000	375,000	$2.50 share, '96.	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	55½	56
Presidio & Ferries RR	100	1,000,000	550,000	....	8½	..
Scranton, Pa—Dec 5:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12½	15
m Scranton & Carbondale Trac. Co..	100	500,000	500,000	....	14	18
m Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Dec 5:						
Springfield Consolidated Ry	100	750,000	750,000	....	....	..
Springfield O.—Dec 5:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	..
Springfield, Mass.—Dec 5:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	200	207½
Toronto Canada.—Dec 5:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	105¼	105¾
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	278	279
Washington, D. C.—Dec 5:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	87⅛	87½
Columbia Ry. Co	50	400,000	400,000	6 % A.	65	75
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	17½	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	133½	134
Worcester, Mass.—Dec 5:						
*Worcester Traction Co.........com.	100	3,000,000	3,000,000	....	12	14
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	98	100
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Dec 5:						
Wilkesbarre & Wyoming Val. Trac	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Dec 5:						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., Oct., '98.	280	282
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '98.	75½	76½
New England Telephone Co	..	10,894,600	10,894,600	$1.50 %, Aug. '98.	138	..
New York.—Dec 5:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	96½	97
*Central & South Am. Teleg. Co.	100	6,500,000	6,500,000	1½ % Q.	107	109
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	175	...
Franklin Teleg. Co.....2½ % guar.	100	1,000,000	......	1¼ % S.	40	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	75¼	76
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	110	..
*International Ocean Tel Co.guar 6%	100	3,000,000	......	1½ % Q.	109	..
Mexican Telephone Co	100	2,000,000	......		..	.80
*New York & New Jersey Tel. Co.	100	5,000,000	3,723,000	1½ % Q., Oct., '98.	141	145
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000		2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	92	..
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., July, '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	93¼	93¾
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Dec 5:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	172½	...
Chesapeake & Potomac Telep. Co.	100	......	......	....	51	..
Chicago Telephone Co	100	......	......		220	..
Central Dist Prtg & Telg. Co. (Pgh.)	100	750,000	750,000	....	132½	134
Empire & Bay States Telegraph Co.	100				75	76
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	77	..
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	112	118
Providence (R. I.) Teleph. Co	50	....	......	....	89½	..
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Dec 5:						
Fort Wayne Electric Co	..	......	......	....	...	..
Ft. Wayne Elec Co, T. Sec. Series A.	25	......	......		...	..
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	...	..
General Electric Co. [new] ...... "	100	18,276,000	18,276,000	......	84½	..
T.-H. Elec. Co..T. Secur., Series D.	..	......			2¾	3¼
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	....	37¾	38¼
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	59½	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Dec 5:						
Edison Elec. Ill'g Co., New York.	100	9,188,000	7,988,000		170	175
*Edison Elec. Ill'g Co., Brooklyn.	100	4,000,000	2,000,000	1½ % Oct., '98.		
Edison Ore Milling Co	100	......	......		11	14
Edison Electric Storage Co					23	30
†General Electric Co. [old] ....com.	100	40,000,000	30,460,000	2 % Q., Aug, 1898.	..	..
General Electric Co. [new] .... "	100	18,276,000	18,276,000	......	84½	85
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.—Dec 5:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	165	175
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Dec 5:						
Edison Electric Light Co	100	2,000,000	......	......	144½	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	53⅛	53½
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	64½	65
*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	......	50c. p. sh., Oct. '97.	..	.
*Penna. Ht., Lt. & Pow. Co.....pfd.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co..	10	6,500,000	550,000	$32500 dis. Jan.11'97	13¾	14
Southern Elec. Light & Power Co..	10	187,500	187,500	....	16	..
Miscellaneous.—Dec 5:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	40	..
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	13
Eddy Electric Mfg. Co	25	......	......	....	....	15
Hartford (Conn.) Elec. Light Co	100	350,000	......	....	125	..
Hartford (Conn.) Lt. & Power Co..	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	177	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	84	..
Rhode Island Elec. Protec. Co	100	......	......	....	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q	157½	158½
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	138⅞	139½
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	. ....	......	....	100	..

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200, of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Dec 5:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh. Nov.16, '98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	92	100
New York.—Dec 5:						
Consolidated Electric Storage Co..	...	......	....	....	9¼	16
Edison European	..	......	....	......	..	...
Safety Car Heating & Lighting Co..	100	......	....	......	103	104
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	86	40
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	99	100
Philadelphia, Pa.—Dec 5:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	..	..
Welsbach Commercial Co.....com.	100	3,500,000	......	....	...	10
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	50	52
Welsbach Light Co	5	525,100	......	....	33	33¾
Welsbach Light Co., Canada	5	500,000	......	....	..	2¼
Pittsburg, Pa.—Dec 5:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	..
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q	117	..
Miscellaneous.—Dec 5:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	13	16
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	55	60
Billings & Spencer Co	25	......	......	....	80	86
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	85	86
Johns-Pratt Co	100	......	......	....	90	100
*Pratt & Whitney Co..........com.	100	......	......	....	4½	8
*Pratt & Whitney Co............pfd	100	......	......	....	45	50
Stillwell-Bierce Co.............com.	..	......	......	....	..	...
Stillwell-Bierce Co..............pfd.	..	......	......	2 % Sept. 1, '98.	95	98
Shults Belting Co	100	500,000	......	....	82	87
St. Charles Car Co	..	......	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Dec 5, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry..........1st mtg. 5s.	....	$29,000	1905	....	.....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*114	114⅛
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*114	114½
‡Watervleit Turnpike & RR.1st mtg. 6s	850,000	850,000	1919	M. & N.	*120	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*116	....
Troy City Railway Co..............1st 5s	....	....	......	......	*106½	......

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Dec 5, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113	114
Baltimore Traction Co........1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	116	116⅛
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103	104
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	117	118
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	......	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	115	116
City & Suburban Ry......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	116	.....
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113½
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	120¾	......

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104	105
West End Street Ry........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105¼
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	..
†Charleston City Ry...........1st mtg. 6s.	850,000	....	....	J. & J.	....	..

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¾	103
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T..............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	105½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	64½	......
North Chicago St. RR........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¾	......
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	101½	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	106½	107
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	103½	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	......
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	96	96¼
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Dec 5, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	106	106¼
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103½	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	112¾
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	108	......
So. Cov. & Cin. St. Ry........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119¼	......
‖So. Cov. & Cin. St. Ry.......2d mtg. 6s.	400,000	400,000	1932	J. & J.	131	134

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	105½	106
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	106	106¼
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	104	104½
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	105
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
*a*East Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	107	108
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,335,000	1905	A. & O.	98½	100
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry.................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	100	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	108	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	107	......
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	......
Winchester Avenue RR....Deben. g. 5	100,000	94,000	1908	M. & S.	102	......

New Orleans La.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR..........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	103	......
Crescent City RR..............1st mtg. 6s.	......	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83⅞	84⅛
New Orleans City RR........1st mtg. 6s.	416,500	899,000	1903	J. & D.	.....	104½
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	107¼	108¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	111	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	89	.
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	103	......

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	110	111
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	120½	......
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	114
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	116	119
Broadway Surface..... ......2d mtg. 5s.	1,000,000	1,000,000	1905	......	103	105
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	117
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	93
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	110	112
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	104½	105
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	105½	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	103	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111	113
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	120
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	107
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	116	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	103½
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	116	118
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	98	99
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	123	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	118	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	115	117
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	....	. ...
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	113½	115
South Ferry RR. Co..........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	127	......
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	102	104
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112½

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Dec 5 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.....................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized.
$600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Dec 5, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry..........1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry..................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943		105½	105¾
Phila. City Passenger Ry.....1st mtg. 5s	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,800,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co..................Col tr. 4s	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry............1st mtg. 7s	....	......	1905		....	....
West Phila. Pass. Ry.........1st mtg. g. 5s	250,000	246,000	1906	A. & O.	115¾	....
West. Phila. Pass. Ry...........2d mtg. 5s	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Dec 5 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	......	......
Central Traction Co................1st mtg. 5s.	875,000	375,000	1930	J. & J	......	......
Citizens' Traction Co..............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	115	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	112¾	......
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	......
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1928	M. & N.	......	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	......
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	....	......
Pittsburg & Birmingham.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	....	......
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	....	......
Second Ave. Traction Co.......................5s.	2,500,000	2,000,000	1934	J. & D.	....	......
Sub. Rapid Transit Railway Co..........5s.	500,000	500,000	1918	M. & S.	......	......

Providence R. I.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,[illegible]60,000	1933	M. & S.	108½	109¼

St. Louis.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co..........1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	109
†Comp. Hts., Un. De. & Mer. Ter...1st 5s	[illegible]	[illegible]	1913	J. & J.	111¼	112⅛

PASSENGER RAILWAY.

St. Louis.

Date of Quotation—Dec 5, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co......................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	107	109
Missouri RR. Co....	1,000,000	700,000	1916	M. & S.	107	108
‖Mound City RR. Co..............1st mtg. 6s.	400,000	300,000	1910	A. & O.	101	103
People's RR. Co......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co......................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	103	104
St. Louis & Sub. Ry...............Income 5s.	300,000	300,000	......	....	65	70
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	112	113
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,737,000	1918	J. & J.	114½	115½

†Controlled by St. Louis RR. Co.
‡Controlled by Union Depot RR. Co.
¶Controlled by Lindell RR. Co.
‖$200,000 in escrow to retire 1st & 2d mtg.
§$600,000 in escrow.
††$200,000 in escrow to retire 1st mtg. bds.

San Francisco Cal.

Date of Quotation—Dec, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	115½	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	114½	......
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	128½	129
†Metropolitan Ry. Co..................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126	......
†Park & Cliff House RR........1st mtg. 6s.	850,000	850,000	1912	J. & J.	106½	108½
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	112	......
†Powell St. Ry........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	128
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......

†Controlled by Market St. Ry. Co.

Washington D. C.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Belt Ry. Co.......................Cons mtg 5s.	500,000	450,000	1920	J. & J.	51	....
Columbia Ry...........................'s mtg. 6s.	500,000	500,000	1914	A. & O.	118	125
Eckington & Soldiers' Home, mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	128	......

†$50,000 in escrow to retire 1st mtg. bds.

Miscellaneous.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	102½	......
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	112½	114
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	110¾	111
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	108	105
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	107	......
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	102	102½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	116	117
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	100½	101½
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	3,000,000	2,378,000	1928	J. & J.	104	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	95	100
St. Paul City Ry.....................Cons. g. 5s.	5,500,000	4,298,000	1937	......	......	......
St. Paul City Ry.........................Deb. g. 6s.	1,000,000	1,000,000	1900	......	......	....

†$1,000,000 in escrow to retire 1st and d mtg. bds.
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.
‖$87,000 in treasury.
§$960,000 res'ved to redeem prior liens.
††$620,000 in escrow.

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.

Date of Quotation— Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	109	110

Pittsburg, Pa

Date of Quotation—Dec 5, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Allegheny County Light Co................6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......

Miscellaneous.—(Dec 5, 1898.)

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	111¼	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	120	...
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	110	115
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	....	......
Edison Illg. Co. (St. Louis)..............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.

Date of Quotation—Dec 5. 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
American Bell Telephone......................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.

Date of Quotation—Dec 5, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
American Electric Heating..............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co........	....	....	......	....	......	25
Barney & Smith Car Co....... ....†6s	....	....	1942	J. & J.	97	100
Carborundum Mfg. Co .... .6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co	75,000	....	......	....	......	....

*Unlisted *Nominal

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12.65@12.75c.; Lake, 12.75@13c.; casting, 12.65@12.75c.

The Cleveland-Chagrin Falls Electric Railway Company has bonded its line for $300,000 and will build an extension to Warren, O., at once.

The Buffalo (N. Y.) Railway Company has declared a quarterly dividend of 1 per cent., payable December 15. Books reopen December 16.

The Philadelphia "Times" states that of the total of 135,000 shares of the Electric Storage Battery Company, 104,704 shares changed hands last month.

The underwriting syndicate of the Baltimore Consolidated Electric Light Company has the privilege of subscribing at par for 200 shares of the new company—$5 a share to be paid—for every $10,000 bonds held. There will be no bonus stock.

Receiver Jump, of the Terre Haute (Harrison) Street Railway & Electric Light Company, has filed his report for the first year of the receivership just ended. It shows a balance of $14,000 from the year's operation, but this does not cover the interest charges on the old debt.

The statement of the instrument output of the American Bell Telephone Company for the month ended November 20 was: Gross output, 35,159; returned, 15,486; net output, 19,673. For the same month in 1897 the gross output was 29,023; returned, 7,817; net output, 21,206.

Twenty-one first mortgage gold 5s of 1889 issued by the Columbus (O.) Consolidated Street Railroad have been drawn for the sinking fund, and will be paid by the Central Trust Company on and after January 1, 1899, at 110 per cent., together with the coupon maturing January 1, 1899.

The directors of the General Electric Company have declared a dividend of $17.50 on the preferred stock, payable December 22 to stockholders of record December 12. This makes the total back dividends paid $29.16⅔. On October 24 $11.66⅔ a share was distributed among the holders of preferred stock.

On January 2 the Boston Elevated Railway Company will pay to the shareholders of the preferred stock of the West End Street Railway Company a regular semi annual dividend of 4 per cent. The dates of the closing and the opening of the transfer books have not been set but they will probably be December 17 and 31 respectively.

In the calendar for the December term of the Supreme Court which will convene at Albany, N. Y., this week are nineteen cases against the Albany Railway, fourteen against the Troy City Railway Company, and three cases against the railroad in reference to the accident at Cohoes on Labor Day when a number of lives were lost.

The Chicago City Railway Company has declared a dividend of 3 per cent., payable December 31. Books close December 16 and reopen December 21. The company, it is stated, proposes to increase its stock at the January annual meeting from $12,000,000 to $14,000,000, and the stockholders will be given the right to subscribe for it at par.

The Metropolitan Street Railway Company of New York has declared a quarterly dividend of 1½ per cent., an increase of ¼ per cent. for the quarter. It is payable January 16. Books close December 28 and reopen January 17. In exactly one month the stock of the Metropolitan Company has gone up 21 points. On November 5 it closed at 164½; Monday it closed at 185½.

A very noticeable feature is the great increase in the consumption of copper in Germany as compared with England and France, this being mainly due to the development and extension of the manufacture in that country of electrical plants and appliances. In England this important and valuable branch of trade has not developed to anything like the same extent as it has done in Germany.

We learn from Philadelphia that all the machinery in the works of the General Electric Automobile Company has been installed and active operations are about to begin. Contracts amounting to $100,000 are said to have been made with the company for the new type of delivery wagon running 60 miles on two chargings at a cost of 60 cents, and 220 of the new type of physician's carriage are wanted at once.

The Edison Electric Illuminating Company of New York has decided to offer to its stockholders the privilege of subscribing at par to 9 per cent. of holdings at the time of closing the books for the next dividend. It has been suggested that the present stockholders be given an extra dividend of 1 per cent. for this year, and that a suggested increase of the quarterly rate be considered for the first quarter of the coming year. The net earnings of the company continue to show a handsome increase.

Albert H. Johnson, president of the Nassau Electric Railroad of Brooklyn, arrived at New York on the Campania on Saturday. In a published interview he states that his trip to London was undertaken in the interest of a project to establish a great trolley system in that city. He declares that he has partly succeeded in his efforts, and that modern trolley service in the largest city of the world may be only a question of a short time. The New York "News Bureau" says: "It is believed in well informed circles that Mr. Johnson's sudden recall indicates a hasty consummation of the 'deal' between the Nassau Company and the Brooklyn Rapid Transit Company."

The Consolidated Railway Company of Baltimore has decided to issue $500,000 of additional stock. This stock will be offered to the present stockholders in proportion to their holdings at par, which is $25 a share. The Consolidated Railway Company has outstanding $9,172,000, and its authorized capital is $10,000,000. It has held in the treasury $828,000, and from this the $500,000 to be issued will be taken. The object in putting out the additional stock is to secure funds to pay for the Ellicott City branch of the Columbia & Maryland Railway, which the company bought, and to meet the cost of reconstructing the line and getting it ready for operation.

The Cincinnati "Enquirer" says: "The order of court for the foreclosure of the mortgage on the Columbus Central Street Railway, which has been awaited for a long time, will probably be soon followed by the sale of the road, which will be bought in by the bondholders or by the committee representing the bondholders. There remains a few matters of minor importance to settle before this can be done, after which the $1,500,000 held in bonds on the property will be satisfied. As to what disposition is to be made of the road after the property is bought in for the bondholders cannot be stated now, though the intimation that the Columbus Street Railway is making preparation to buy it in has a good source for authority."

A Wilmington, Del., paper states that an electric railway syndicate with large capital, which contemplates building a trolley line from Philadelphia to Baltimore, has its eyes on the Wilmington & Brandywine Springs Railway, and it is understood an effort will be made to secure it or a controlling interest in the near future. The syndicate, it is understood, hopes to have a series of electric railways in operation within the next few years between Philadelphia, Wilmington and points southwest and south. If the Brandywine Springs road is acquired, the plan is to build a road running from that point to Kennett Square, Pa., and from Kennett Square to New London, and thence by a route which will touch at all the more important towns in a southerly direction, terminating in Baltimore, where it is likely that arrangements can be made for a link to Washington, and possibly further south.

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CONTENTS.

EDITORIAL NOTES.

The Bell Telephone Company and Its Earnings.

The New York *Herald* has of late been discussing very thoroughly the existing telephone situation, and has given some figures showing the expenses and earnings of the American Bell Telephone Company since its inception which are exceedingly interesting to say the least.

According to the *Herald* what was known as the Bell Telephone Association was organized without capital in Boston in 1877 for the ostensible purpose of exploiting the patents granted to Alexander Graham Bell the year previous. The following year, in 1878, the so-called New England Telephone Company was organized, with a total capitalization of $200,000, only one-quarter of which represented cash, with the right to use and to authorize others to use and manufacture telephones under the patents taken out by Bell. The Bell Telephone Company was organized in Boston with Gardiner G. Hubbard as president in 1878. Of its total capitalization o $450,000 the Bell patents represented $400,000. Shortly after this, in 1879, the New England Telephone Company and the Bell Company were consolidated, taking the name of National Bell Telephone Company, having a capital stock of $850,000 paid in, which, using the *Herald's* figures, was accounted for as follows: "Patent rights to use a Bell telephone in all parts of the United States, $650 000; telephone and apparatus, $83,000; 4-10ths interest in New York district system, $35,000; Chicago district system, $45,000; Boston district system, $17,000; Lowell district system, $5,000; cash, $10,000."

In 1880, or after the suit between the Western Union Company, which had begun putting in a telephone system in New York City, and the National Bell Telephone Company had been practically won by the latter organization, the Massachusetts Legislature incorporated the American Bell Telephone Company with a capital stock of $10,000,000. Regarding this new corporation as organized the *Herald* says:

"It was to make and use and license others to use telephones, and license public and private lines and district exchanges, with a capital stock of from $1,000,000 to $10,000,000. The new company organized with $7,350,000 'paid in.' The patent rights, leases, good will, etc., of the National Bell Telephone Company were put at $6,500,000; patent rights, etc., in the Telephone Exchange in Boston, the year before worth $17,000, at $300,000, and cash, $543,100. Each share of stock in the National company was now made into six shares, and the stock in the new company almost immediately sold at par."

Dating from this period telephone companies sprang up all over the country as offshoots of the parent company. The New York Telephone Company, formerly known as the Metropolitan Telephone and Telegraph Company, is one of these, the American Bell Telephone Company owning a large portion of the stock of this corporation as well as exacting a royalty of $14 a year on each instrument in use. An idea may be gotten of the exclusive monopoly enjoyed by the American Bell Telephone Company since 1880 when it is stated that, beginning with an actual cash capital of $543,100, the gross earnings during the past eighteen years are given as $65,401,736.02, while the operating expenses during the same period were but $22,391,971.44, leaving an apparent profit of $43,009,764.58. The capital stock of the Bell Company at the present time is said to be $30,000,000, on which dividends of 18 per cent. are being paid.

The above figures would seem to prove conclusively that a charge of $240 a year for unlimited telephone service, as demanded by the local company in New York City, is exorbitant, and could be reduced by more than one-half without affecting the stability of the organization, and we are pleased to learn that another attempt is to be made at the approaching session of the New York Legislature to reduce the cost of telephone service throughout the State, with a better prospect of success apparently than at any previous session. That an entirely satisfactory measure will be adopted by an Albany Legislature can scarcely be hoped for, and it is therefore gratifying to know that there are positive indications of relief in another quarter. The new People's Telephone Company, whose canvassers are now at work throughout the city, is meeting with more encouragement even than was anticipated, and has already obtained nearly 10,000 subscribers, the number at which it promises to begin business. This company, with a paid-up capital of $5,000,000, and backed by several prominent members of the New York Board of Trade, is the first independent organization that has succeeded in gaining a foothold in the metropolis, and deserves, as it is getting, the hearty support of all persons interested in obtaining telephone service at reasonable rates.

* * *

The Street Railways of the United States.

Wonderful strides have been made in the street railway mileage of this country since 1880, the extent of which cannot be fully realized until the actual figures are placed before one. The tenth census, taken eighteen years ago, or about the time the trolley first made its appearance, showed a total street railway mileage in the United States of but 2,050 miles. With the ex-

ception of a few miles of track used for experimental purposes, animal motive power was universally used. The eleventh census, taken in 1890, showed a street railway track mileage of 8,123 miles, of which about 1,260 miles, or slightly over 15 per cent., was being operated by electricity. Of the 8,123 miles of track but 488 miles were being operated by cable, showing that even at that comparatively early period of electric traction the latter form of motive power was far more popular than traction by cable, owing undoubtedly to the fact that the cost of installing it was less. It is since 1890, however, that the great increase in the use of electricity as a motive power has taken place. A report issued by the *Street Railway Journal* in 1897 placed the total mileage of street railway in this country at 15,718 of which 13,765 miles were being operated by electricity. This showed a decrease in animal traction for the seven years preceding 1897 of 83.3 per cent. and an increase of the use of electricity of 990.7 per cent. During the same period the figures given show that cable traction had by no means become very popular, there being an increase of but 51 miles. At the present time it is estimated that the street railway mileage in this country ranges in the neighborhood of 16,300, of which probably some 15,600 miles are operated electrically, and it is thought that at the present rate of increase the close of the century will find the United States provided with a network of street railways aggregating a mileage of 20,000. The *Street Railway Review* recently published a short article bearing on the subject of street railways in which it brought out the greatness of this industry in a rather unique way. Among other things it said :

"If the street railways were to be sold the sum realized would easily pay the debt of the United States. A fair estimate of the paying passengers carried by the street railways per annum would be 2,660,000,000, and this would be increased by 50 per cent. if the transferred passengers were included."

Referring to the amount of power required to operate all the railways, it continues in the following strain :

"It is estimated that the power stations have an aggregate capacity of 525,000 HP., and consume per annum 2,300,000 tons of coal, evaporating 3,300,000,000 gallons of water. To operate the present street car equipment would require 320,000 horses, which, if harnessed two abreast, would form a solid procession extending from Chicago to Cleveland ; but to transport the passengers carried by electric cars in the slower-going horse cars would necessitate one-third more cars than now, and this would extend the line of animals to 480 miles."

The fact that Europe, with a population of about 400,000,000, has at the present time but in the neighborhood of 10,000 miles of street railways, whereas this country, with a population of one-fifth the number, is provided with over 16,000 miles, certainly speaks well for the progressiveness and energy of the people on this side of the Atlantic.

* * *

Limited Use of the Telephone in London.

Several rather sensational articles have lately appeared in England condemning the manner in which the city of London is lighted, and claiming moreover that it is the darkest capital in Europe. Whether this is so or not we leave our technical contemporaries on the other side to decide, as several of them were apparently eager to pick up the gauntlet thrown down. What however is more surprising to us, and no doubt will be to our readers, is that the Police Department of London does not make use of the telephone. According to one of our English contemporaries, there is not a police station in the whole of that great metropolis equipped with an instrument that has become almost as common and as necessary in New York City as the electric light. The absence of the 'phone in one of the most, if not the most important branches of the city's service is due, so it is alleged, not to any fault of the local telephone company, but rather to an unusual conservatism exhibited by the authorities, who have repeatedly declined to avail themselves of the privilege. In this respect the authorities of London are apparently showing the same spirit which prompted many of the banking houses to decline to have a telephone installed on their premises on the ground that "it was not quite respectable."

How the Police Department in a city such as London can get along without some speedy method of communication such as only the telephone can supply is incomprehensible to the ordinary mortal on this side of the Atlantic. In New York City in the event of a child's becoming lost or a person disappearing every police station in the department is notified to that effect by telephone in less than half an hour from the time the news is received. We should like to know how this sending out of a general alarm and description is accomplished in London. Possibly a dozen messengers are dispatched to make the rounds of all the stations, or the telegraph is made use of. As a contrast to the methods adopted in London it may come as a surprise to some of our English readers to learn that during civil and military parades in New York City booths are erected along the route the procession will follow, to enable the Chief of Police at headquarters to be constantly kept informed as to the whereabouts of the parade or told of any unusual disturbance. The Fire Department of London, in contrast to the Police Department, has telephones in all the fire houses, but the arrangement is such that when a fire call is sent by telephone it is obliged to pass through several exchanges entailing considerable loss of valuable time. This objectionable feature could be overcome by an expenditure of $50 a year for each station, but small as the cost would be it is apparently considered by the authorities wilful extravagance, and matters are left as they are. In New York arrangements have recently been completed for attaching telephones to every lamp-post having the ordinary signal box, so that communication may be established between the location of the fire and headquarters.

Under the Searchlight.

Notes and Comments on Various Topics.

AT the Merchants and Manufacturers' Board of Trade meeting at the Hoffman House in this city, on the evening of the 7th inst., the Telephone Committee, of which R. M. Walters is chairman, reported the draft of a bill to be submitted to the next session of the Legislature making it unlawful in any city of this State containing a population of 500,000 or more to charge any single telephone subscriber more than $50 a year for any number of messages less than 1,000 transmitted within the corporate limits of said city, or to charge more than 5 cents for each message in excess of 1,000 ; persons or corporations overcharging to forfeit $100, to be recovered with the excess charges by the person paying the overcharge, if action is begun within one year. The Telephone Committee is composed of R. M. Walters, chairman, Leo Schlesinger, Amasa Lyon, Charles Heckman, Francis O'Neill, Andrew Patterson and C. Du Brul.

* * *

ACCORDING to the *Times-Democrat* of New Orleans an expert in the employ of the New Orleans Telephone Company has just returned from Europe where he had an opportunity of seeing the much-talked-of telephone newspaper of Budapest, regarding which he says: "The apparatus in my room consisted of a curved steel trap to go over the head with a very small ear piece at each end. It was attached to a flexible cord about fourteen feet long and could be moved about as one chose. There was also a sort of buzzer fixed in the wall and when anything of special importance was about to be transmitted it gave out a faint hum. Over the buzzer was a printed programme for the day, including numerous musical selections and several recitations of poetry. I clapped the thing on my head immediately and was startled to hear a deep bass voice bellowing a stream of Hungarian of which I understood not a word. I had no idea it would be so loud. The speaker seemed in a tremendous hurry and his gabble was something appalling. Between communication, the machine made a clacking noise, like winding a clock—why, I could never learn. I sampled the music later and found it good. The thing was certainly great fun until the novelty wore off, and I used to take it to bed with me sometimes. They talked advertisements over it between the news items, and I was told that they got a good rate. But I have my doubts about it paying. I encountered hardly any citizens who had it in their houses. They seemed to regard it as a toy to amuse foreigners."

* * *

A CONVERSATION by telephone lasting three minutes may be carried on from Berlin to any part of Germany for twenty-five cents. For a conversation with a locality outside of the German Empire the fees range between fifty cents and one dollar. It is unnecessary to state that the above rates are considerably lower than the rates charged by the Bell monopoly for long distance service in this country.

* * *

THE would-be automobile cab drivers in Paris are obliged to take lessons in the handling of the horseless vehicles before being allowed upon the public thoroughfares. The Compagnie Generale, which owns the cabs, has, so it is said, a training track nearly a mile in extent over which the apprentices run electrical carriages until they are proficient in guiding them. The track has all the varieties of pavement that abound in Paris, with billy spots, etc., and dummies representing trucks, human beings, bicyclists and animals are distributed along the course. The apprentice dodges in and out among these until he has perfect control of himself and his vehicle.

* * *

AN officer of the New York Telephone Company is said to have a telephone directory brought from Santiago by a telephone man, a member of the Seventy-first Regiment. It shows that there are some ninety subscribers to the telephone exchange at Santiago, who paid the neat little sum of $25 each per month, or $300 a year, for the service. Has the American Bell Telephone Company already turned its attention to Cuba?

* * *

DISCOURAGING rumors are afloat regarding the prospects of the Paris Exposition of 1900. Little real progress has been made on the huge buildings, and it is thought possible the Exposition may be postponed until 1901. President Faure has visited the grounds and tried to stimulate the work. But the recent strike and difficulties between the municipality and the Government have left poor prospects of completion in time.

New Albany, Ind.—William Rothrock, proprietor of the White Cloud mills and an extensive land owner in Harrison county, this State, is interesting local capitalists in a projected electric road from Nevin, Harrison county, to Leavenworth, Crawford county, by way of White Cloud and Wyandotte Cave. The proposed line is to be thirteen miles long and extends from the Corydon branch of the Louisville & St. Louis Air-line to the Ohio river. Mr. Rothrock has a plan for supplying power for the proposed road that is novel and at the same time practicable. He proposes to place a power house at White Cloud, which is about the center of the road and on Blue river, and generate by water power the electric power for the road.

PRACTICAL POINTS IN STREET RAILWAY ENGINEERING.*

BY W. A. HARDING.

It was suggested to me that rather than present to you a paper full of data, etc., I should call your attention to the different points of interest and problems that are met with in practical street railway work, so you could start a discussion and give to each other your personal experiences.

First, I must call your attention to the fact that it is impossible to make any arbitrary laws for the conduct and management of street railway property, conditions altering under various circumstances; financial conditions, condition of travel, nature of ground, locality, speed and climatic conditions, all require different management and different problems to solve.

A road running through a very thickly populated district with good roads, etc., has the cost of operation at a minimum and can afford to spend a few thousand dollars to raise low joints, put in plenty of feed wires and keep cars well painted.

But take a road running out far into the suburbs and sparsely settled districts: to put up feed wire, keep up voltage as it ought to be and to raise low joints would bankrupt the company, and as for painting cars, it is out of the question. Many a country road runs through marshy land, making low joints the rule. The mud and water may be thrown all over the cars, and if this is of an alkaline nature you can easily see what becomes of your paint. Motors that under ordinary conditions are called water tight will here fill with water unless extreme measures are taken to provide against it.

The choosing of a suitable car and equipment in the past consisted of buying car, truck and motor, without any reference as to their suitability to each other, and car or truck would have to be rebuilt to fit. I remember a company that bought long 36 ft. combination cars, closed in the center and open, with seats at each end, having two massive four-wheel center pivot trucks, and put in two 15-HP. motors. Grades were from 3 to 12 per cent. It was only a short time before the motors were completely roasted. The company then went to the expense of cutting the body down to two-thirds size, taking one truck and lengthening out to 7 ft. and putting in two 15-HP. motors. The equipment now ran very satisfactorily, but owing to poor construction of the car body, they would "hog-back" in a very short time, necessitating constant renewals of subsills, etc.

Now what cars shall we use? Take a supposed case. For winter the public demands a five-minute schedule and the average load is from 25 to 35 people, during rush hours say 100 people per load. We do not want to haul around a large car empty half the day, so we will put on a 22 ft. car, as large as is advisable for a single truck, with two motors and large and roomy platforms; if in a cold climate, preferably vestibuled. Now if the cars should be a little crowded, the platform would always accommodate a few. When the rush comes on one or two trailers could be added for a few hours. If quickness and dispatch in unloading are not the predominating features, or too many transient passengers, a large double truck trailer car is in my mind much the better. They are easier for motormen to handle than two single truck cars, easier to ride, easier on the track joints, require one conductor in place of two and can make much faster time.

During the summer the same rule applies, except that when the climate allows, open 10-bench cars should replace the closed ones. If travel warrants it, there is still a better field for larger cars (which have side entrances) making less units.

Now in the suburban districts sometimes the smaller cars will not accommodate your passengers and yet you say you cannot afford to put on more cars. Now you can use your large cars to advantage. In fact, you can sum up the whole problem as follows: Use the largest seating capacity cars that a satisfactory schedule will warrant. For suburban travel where speed is the main point double trucks having four motors can be run faster than single trucks, with less wear and tear on equipment, track and passengers.

A word as to trucks. They should be built with the side bar in one piece, having no bolts or rivets except where the cross braces for hanging brakes are placed. Brake shoes should not be hung on links, but in such a way that they cannot kick and will take up their own wear. An average wheel base of 8 ft. is proper for single trucks when under a 22-ft. closed body, or 10-seat open bench car. Springs should be graduated to allow the car to ride easily without undue oscillation. The same rule applies to trucks for double equipment only the wheel base should be as short as the motor truck will allow, also allowing for the car to oscillate sideways.

The motors should be carefully chosen for the work to be done. A powerful motor if put under a light car hauling trailer will slip the wheels on the track and the car will not make sufficient speed; but if car body, trucks and motor are of sufficient weight to get the best traction, the train will now make faster time. The bearings of the armature should be large and fed from below with wick feed from oil, with box above to hold wool waste with additional oil in place of the usual plan of dope. Such bearings should be built outside of the motor frame and also protected by large circular disks to prevent the oil from working into the motor.

The commutator should be made of good drop forged copper bars, the diameter to be as large as possible. In G. E. 800 we use a bar $1\frac{1}{2}$ in. high. By using soft amber mica between the bars the commutator wears smooth and keeps it polished. The number of slots in the armature should be kept as low as possible, it being cheaper to make repairs when four to six coils can be put into one slot; also coils should be machine wound, a thing not possible with all our armatures now.

A motor, if carefully kept clean, the brushes properly treated and changed each night and not abused unnecessarily by the crew, will last without rewinding for from four to five years, and even longer. With proper attention to brushes, commutators of the modern type should wear not more than $\frac{1}{8}$ in. per year.

It will take too long to go into track and line construction in this paper, but I will just touch on a few points.

How are we to get the voltage raised at a distant point of the line where it is required for only a few weeks in a year? The cost to install a storage battery or booster, or to put up more wire, is all out of proportion to the returns. Take one of your dynamos with a capacity equal to the load demanded at this particular point. Change your two switches to double throw. When thrown up all connections are for running as a dynamo on the switchboard in the usual way. By throwing blades down, the + of machine is thrown onto an auxiliary bus bar and the — onto the positive main at the switchboard, making this particular dynamo in series with the station.

The equalizing switch is left open; the field wires are not altered. The dynamo is now run at whatever voltage you need, may be 200 or 300. The feeder that goes out to the point of the line where you wish voltage raised is now thrown onto this booster, as we must now call it. Again, if the feeders are properly adjusted, a switch and fuse can be put in between the circuit breakers of several sections and a whole district raised in voltage, if only for a few hours during rush time. As the station usually holds a reserve unit, there is no additional outlay or expense needed. In case of a breakdown or disabled generating unit, the boosting would be discontinued until such time as repairs were made.

Accumulator traction has greatly improved—batteries are more durable—and it certainly has a future of its own. Cars running without interference from outward sources or with each other cannot be overlooked, but I think they are not generally suitable, for the expense of changing batteries on all the outlying districts of a large system would be enormous.

A few of the disadvantages are: increased weight of car, an expensive roadbed, depreciation of the batteries and difficulty of recharging under all conditions.

I was asked the comparative cost of operating different systems of street railway, and will quote from the report of H. H. Vreeland, president of the Metropolitan, New York, the following statement:

Expense of operating horse cars......17 87 cents per mile.
Expense of operating cable cars...16.42 " "
Expense of operating electric cars..10.23 " "

In each case conditions were equally favorable for the system used.

* Read before the Chicago Electrical Association, Dec. 2, 1898.

ELECTRIC TRAMWAYS OF MONACO.*

The electric tramway recently installed at Monaco bears a superficial resemblance to the Claret and Vuilleumier surface contact system which has been employed to some extent in Paris, where it has not proved entirely unobjectionable. In the system used at Monte Carlo there are contact studs, but there is an absence of complexity in the working parts which constitutes an advance on several other systems that have been more or less discussed. It will be readily understood that the authorities of the principality would not adopt any method of traction which might conceivably detract from the appearance of the streets. They maintained that the demand for a tramway was by no means exigent, and unless some system could be devised that would in no way interfere with the appearance of the roads they were averse to a tramway.

In these circumstances a system was proposed which has now been constructed and which presents no conspicuous features in the roadway besides the ordinary traction rails. The contact studs, to which reference will be made in due course, are placed between the rails, but they present little obstruction.

The site of the tramway is, perhaps as well known as that of any other in Europe, and probably no other can surpass it in charm of scenery. Every visitor to the Riviera is familiar with the picturesque citadel of Monaco, the capital of the little principality that includes besides the city a strip of coast about nine miles in length, which is flanked close in shore by the French province of the Maritime Alps. The rock-crowned heights behind the terraced streets, the blue stretches of the Mediterranean, the sinuous indentations of innumerable bays that form the varied shore line, and the brilliant sunshine of southern France compose a picture that ought to make the fortune of any tramway syndicate which was fortunate enough to secure the requisite concession. Some idea of the situation of the tramway may be gathered from the accompanying illustrations. The first view includes practically the whole route. At the railway station near the base of the promontory on which stands the citadel of Monaco, is the western terminus of the tramway, while beyond the next point the towers of the Casino at Monte Carlo can be faintly traced. The route follows the shore-line closely, and in the second illustration a car appears ascending the Avenue de Monte Carlo, the Citadel of Monaco appearing in the background at the right. The main line extends beyond the station to the boundary of the principality at Saint-Roman. The total length of the route from Monaco to the Casino is about

* Abstract from the *Railway World*, London.

three miles. It is intended to construct a line from the railway station at Monaco to the town proper, and ultimately the system will have a total length of about six miles, but this will form only a first stage in an important line of electric railways to connect Monte Carlo and Mentone via Nice. This will enable travelers to enjoy the incomparable panorama which the shore presents without the interruption of the numerous tunnels through which the existing railway passes.

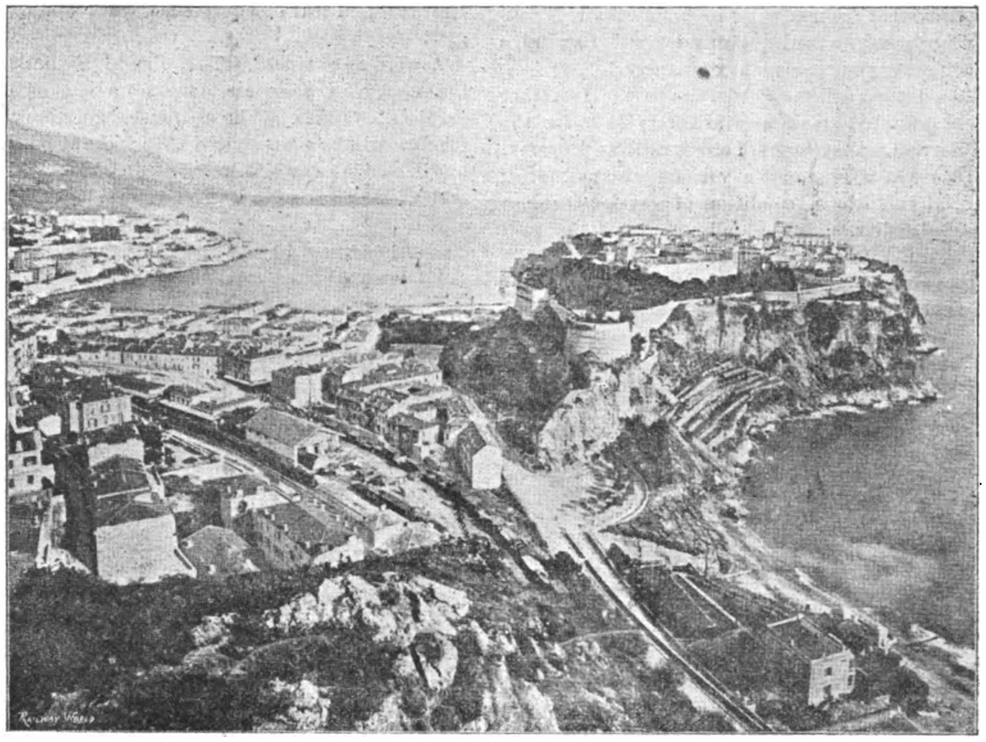
The permanent way of the lines now constructed consists of grooved girder rails weighing about 73 lbs. per yard, spiked to transverse wood sleepers and tied by rods at the usual interval. The sleepers are covered with the road metal to the level of the rails, which serve for the return circuit as in the overhead trolley system, and are therefore thoroughly bonded. The gauge of the track is one meter. The gradients are numerous and varying. A view of the principal one on the Avenue de Monte Carlo is shown below; its length is 1,320 ft., and the rise is 1 in 12.5, occasionally increasing to 1 in 11. There are specially sharp curves, 66 ft. being the shortest radius which it was necessary to use.

SYSTEM OF TRANSMISSION.

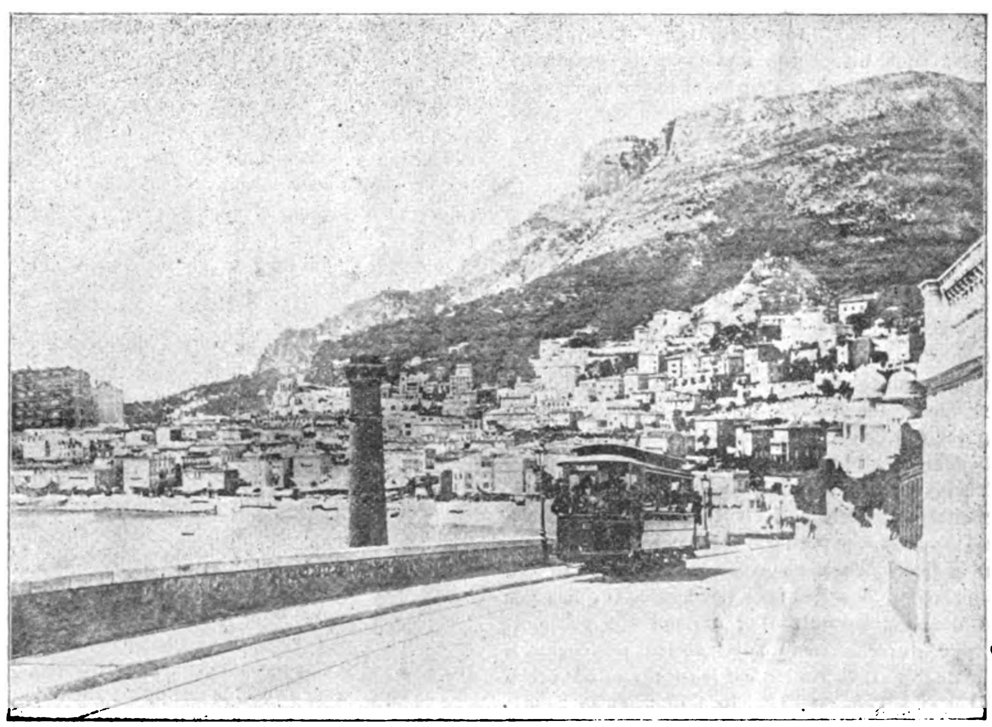
Current is conveyed to the cars by underground cables, and contact studs, which are charged only when the car is passing over them and they are being pressed by the contact shoes that are placed under each car. The contact studs are disposed alternately in two parallel lines, each placed at a distance of about 10 in. from the nearest rail. These studs consist of a contact piece, shaped like a mushroom, with a shaft or stem screwed into an iron cylinder. In the lower part of the same cylinder, which is threaded throughout its whole length, there is previously screwed a piece of copper, presenting an interior cylindrical orifice in which is soldered the end of the cable which serves to conduct the current. The whole is solidly fixed in a block of wood which is itself encased in a cast iron box. In the negative or low potential series, these iron boxes, which completely surround the wood boxes, have an exterior base forming a single body with them. They serve as an electric screen, and they are connected to the traction rails by a copper cable. When the boxes are placed in position they are fixed to the transverse sleepers by means of long screws passing through the exterior base. In the other, or high potential series, the boxes are unprovided with an exterior base, and do not entirely fill the wooden box. They are secured interiorly to the sleepers. This latter series of boxes transmits the current from the feeders to the motors. By suppressing the exterior base of the iron box the distance is increased between the metallic part of the stud and the rail, and the loss that might be produced by leakage is diminished. The cables which are inserted in the lower part of the studs connect them electrically to commutators or automatic switches placed in small pits constructed at intervals along the line. These pits have a depth of 6 ft. 6 in., a length of 8 ft. 6½ in., and a width of 3 ft. 6 in. They contain twenty-two switches arranged in two horizontal series, six upon each of the smaller walls, ten upon one of the larger. The fourth side is left clear so that inspection of the apparatus may easily be made. The various apparatus are affixed to boards of creosoted pitch pine secured by corner irons fastened to the walls of the pit, which is itself covered with a coating of cement.

Above the free side there is a manhole covered with an iron lid, beneath which there is another cover, closed firmly by bolts, which forms a hermetical joint, designed to prevent the entrance of water into the pit.

The switches consist of an electro-magnetic bobbin, in which moves a bar of soft iron that actuates an iron plate. This plate or armature carries three small pieces of carbon electrically united by the plate itself. When this armature is raised these carbons coincide with three copper contacts (placed under the bobbin) which are themselves insulated from each other. One of the contacts is permanently united to the principal feeder, the other two are connected respectively to the cables communicating with two successive contact studs of the high potential series, and on the other hand with contacts corresponding to the neighboring switches. As soon as the bobbin is demagnetized the iron plate falls and the studs, which when in contact with it are at a potential of 500 volts, naturally fall out of circuit. A magnetic blow-out placed beside the switch prevents the formation of an arc when the iron plate in falling cuts off the current.



BIRDSEYE VIEW OF THE ROUTE OF THE MONACO ELECTRIC TRAMWAYS.

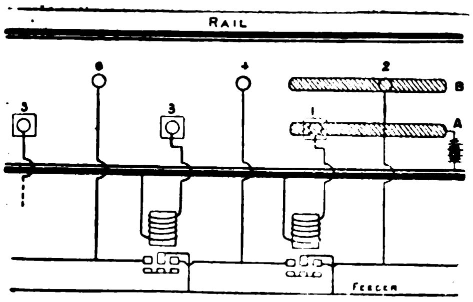


CAR ASCENDING THE AVENUE DE MONTE CARLO.

As in other contact systems, the current is taken from the studs by parallel contact bars placed underneath the cars. In this case these bars are two in number, and they are supported by pieces of iron fixed to the motors. A double system of levers actuated by a self-regulating spring is said to give a sufficient pressure of the shoe upon the contact stud without causing the shoe to rub along the surface of the street. The tops of the oval heads of the studs project above the surface about .55 in.

Referring now to the sketch which gives a diagrammatic view of the circuits, the operation of the system can be explained in a few words. Contact studs, numbered respectively 1, 3 and 5, belong to the negative or return series, while numbers 2, 4 and 6 represent the high potential or feeder series. In order to put the car, of which the contact bars A and B are placed as shown in the figure, in motion, a small battery in the car is put in circuit with bar A, the other pole being constantly connected to earth through the car wheel and track rails. As soon as the current traverses the bar A, the stud 1 conducts it to an electro-magnet, and thus to the return circuit, which is formed by the rails in the usual manner. While the current continues the magnet is energized and attracts and holds the plate of iron, putting it in the feeder circuit and making connection with the studs numbered 2 and 4.

The current from the main feeder thus passes through the stud 2, and by means of the iron contact bar B to the motors, the return current passing by the stud 1 and the magnet to the rails. The battery is rendered at once useless, as the return current serves to keep the magnet energized, and so to keep the feeder circuit open while the contact bar A is over stud 1. As soon as bar A touches stud 3 the return current passes by a new circuit and traverses the coil of the second magnet. At the same moment a plate is drawn to that magnet and studs 4 and 6 are connected to the feeder. Inversely, as soon as bar A has left stud 1 that magnet is deenergized, and stud 2 is out out of the circuit, stud 4



DIAGRAMMATIC VIEW OF CIRCUITS

being still fed by the second switch. The studs are placed at intervals of 16 ft., and each pit serves to work 45 studs, extending over a length of 281 ft.

ROLLING STOCK.

The carriages are of a novel type. They were built especially for this service, and they are mounted on Brill 21-E trucks. The truck is of meter gauge and its wheel base measures 6 ft. 6 in. The wheels are 33 in. in diameter. On each axle is mounted a Thomson-Houston motor (type G. E. 53). The cars are fitted with electro-magnetic brakes in addition to the ordinary hand brakes, and there are two sand boxes.

The cars, which have accommodation for thirty-six passengers, twenty-four inside and six on each platform, have two compartments, for first and second class passengers respectively. The extreme length of the car over the dashboard is 27 ft. 6 in., the platforms being 4 ft. 2 in. long. The body is thus 19 ft. 2 in. in length. The width of the body is 6 ft. 1¾ in. at the floor sills and 6 ft. 8½ in. over the posts. Each compartment accommodates twelve persons, the seats being placed transversely, those on one side of the aisle being single seats. In the first-class compartments the seats are upholstered and covered with olive plush, and in the second class they are of cherry wood laths with high backs. The windows have cherry sashes and are fitted with spring roller blinds. The platforms have folding gates. The exterior of the car is painted a dark olive green with the coat-of-arms of the principality in the center of the waist panel.

Opening of the Dusseldorf-Crefeld Light Railway.

The London *Electrician*, quoting from the *Electrotechnische Zeitschrift*, gives the following particulars of the official opening on November 10 of the light railway between Düsseldorf and Crefeld and the new bridge built for it across the Rhine near Düsseldorf. The line, which has been built by Messrs. Siemens & Halske, has a total length of 14 miles, the length of the track being 18½ miles. The steepest gradient is only 2.5 per cent. As it will to a certain extent carry trucks between private sidings and the State railways it has been built standard gauge. Two sizes of motor cars are used, those for local traffic being fitted with two motors of 20 HP., while those for long distance work contain two 35 HP. motors. A power station of 360 kilowatt capacity furnishes current to the overhead line, and an accumulator sub-station has also been erected containing two batteries each of 118.8 kilowatt capacity. A speed of 25 miles an hour will be attained on some sections of the line.

PROF. GEORGE FORBES ON LONG DISTANCE TRANSMISSION OF ELECTRIC POWER.

Prof. George Forbes, F. R. S., M. I. C. E., who needs no introduction to American electrical engineers—especially considering his connection with the Niagara Falls works—has just been reading an interesting paper before the Society of Arts, London, on the subject of "Long Distance Transmission of Electric Power." The following is a report of the most important portions of the paper :

This subject [long distance transmission] has been much talked about, but little has been done, and even at this moment there are few people who realize what a vast field there is in this way for investment of capital on a sound commercial basis. Hitherto people have been appalled at the capital required for copper conductors. In the present paper I bring forward nothing new. I use the methods which have been used for shorter distances, and I do not propose to suggest the use of electric pressures which have hitherto been considered unattainable. In all cases it is assumed that the power is generated by a waterfall driving a turbine which rotates a dynamo machine. The electric pressure may be raised by transformers. It is then carried by bare copper conductors to a point perhaps hundreds of miles distant; the pressure may there be lowered. The current is then passed through an electric motor which drives stamps, or mills, or pumps, or hoists, etc. In this paper there is no time to devote to consideration of different systems or kinds of machinery, or of replacing copper by aluminum. It is a plain unvarnished tale of the ordinary methods in use extended to somewhat greater distances.

During the progress of the electric works at Niagara Falls, attention was much given to the economic problems involved in the transmission of electric energy to a distance. But in that case clearly the following financial conclusion ruled the conditions : It is always more profitable to bring the works requiring power to the electric source of power than to transmit the power to a distance *provided*—and in most schemes this is a large if—you can find consumers to come to your locality. At Niagara this seemed likely, and consequently distance transmission beyond 25 miles was considered undesirable in the first instance.

I am here as an advocate of very distant transmission in all cases where it pays, and I know that it will yield a splendid return in many cases that have come under my notice. In all cases it would pay if there were a demand for the power at suitably high rates.

Of all industries to which it is applicable, gold-mining is the one which has come mostly to my notice as wanting a continuous supply of power day and night, and often without any economical means of getting it except by electric transmission. In these cases it will often be profitable to the gold-miner to pay a high price for his power.

The distances with which I have had to deal go up to 250 miles in India, New Zealand and Egypt, and if the Rhodesia mines show generally such returns as the Geelong and Selukwe mines have done, I have shown that the power of the Victoria Falls may be economically transmitted in some cases to 500 miles and pay well.

Waterfalls will be valuable assets in the future. At present the difficulty of using their power generally lies in the fact that there is no demand for power in the neighborhood. Some industries, like those connected with aluminum and carbide of calcium, are ready to go considerably out of their way to plant their works near a source of power. There are not many such industries. . . .

I will now speak to the financiers who may think of taking up electric transmission.

TO FINANCIAL MEN.

The financiers in the city of London or elsewhere who enable the projects of engineers to be carried out, even when they possess no technical knowledge have a wonderful instinct by which they know the important points to be certain about before supporting a scheme with their money. Erroneous opinions on engineering points may for a time prevail, but not for long.

Many examples of this insight might be given, but let us confine the matter to long distance electric transmission. I will give you four objections which are always raised :

1. "Has electric power ever been carried to such distances as you speak of?" The answer is "No." But electrical practice is advancing by strides. In 1882, at Munich, Marcel Desprez earned great credit for transmitting electric power 35 miles and getting a return of 25 per cent. But, in 1891, 70 per cent. efficiency was obtained between Lauffen and Frankfort, the distance being 108 miles.

2. "Are you sure that no new electric difficulties will arise when you go beyond the 108 miles of transmission, which has been accomplished ?" The answer is, "We are sure of this from the tests made at Frankfort." [Only one difference between short transmissions and the 108 miles from Lauffen to Frankfort was found to exist and it had been anticipated by me in preparing the Niagara works. In 1892, I laid it down as essential for the works at Niagara, in order to be prepared for long distance work and for other reasons, that the frequency of the alternations should be as low as the construction of a good dynamo would warrant. In 1894, the tests at Lauffen-Frankfort were published, showing that without this low frequency no good efficiency could be got from the long distance power transmission owing to the great self-induction of the line.]

3. The financier again asks, "Are not the losses by leakage on a long line insurmountable?" The answer is, "There is hardly any loss by leakage. There is loss of power used up only in warming the transmission lines." But this loss can be calculated accurately, and in those cases where the wasted power costs little enough, we are glad enough to waste it if it saves copper, which is the great cost.

4. The business man then asks, "Well, but if you allow a great loss of current in transmission, do you not require an enormous quantity of copper to carry the extra current which you have to generate?" The answer is that this is perfectly true if you allow the losses to be too great, but up to a loss of 50 per cent. on the transmission line you are always saving copper by having greater losses on the way. In fact, every engineer who has made a serious study of long distance transmission will bear me out when I say that the cases in which electric transmission will pay can be clearly differentiated from those which will not pay, and the whole question is principally one of £ s. d. Also, that all engineers will agree as to what is the principal item of expenditure, viz., the cost of copper under the conditions of existing practice. Improvements may reduce this cost, but cannot increase it; hence the financier may be sure of the data of expense, and if he can be equally well assured of the data of revenue he has before him everything required for forming a sound judgment. Let us take three cases.

1. Suppose a water-power is utilized for distant transmission of 200 miles to a gold mine where transport is difficult and the ore rich. Suppose that the miners are ready to pay £100 per annum for each horse-power delivered continuously to the stamps, etc.—I am taking what may be looked on by some as an extreme case, but there are many such places in the world—suppose that it is a gold field employing only 1,000 horse-power continuously, the gross income is then £100,000 per annum. This is a large sum, and will warrant a very large capital expenditure.

Now if it is a case in which 20,000 volts of electric pressure may be used, less than 900 tons of copper is required, after 50 per cent. has been added for self-induction, giving an inefficiency (inverse of effi-

ciency) of only 1.4. Thus 1,400 horse-power will have to be generated at the waterfall end of the transmission line for 1,000 horse-power delivered at the other end—the gold mine. The hydraulic and electric machinery are not likely in a favorable case, even with costly transport, to exceed £14,000. The working expenses are small, and clearly the great thing to be considered is the cost of copper. This might amount to £80 per ton of copper laid or £72,000. Very likely the whole cost would be under £100,000, which with a maximum possible annual expenditure of £20,000 would produce a revenue of £80,000 per annum or 80 per cent. I am sure that actual cases exist where this might be done.

2. If the distance were 400 miles, all other things remaining the same, the only serious difference is in the cost of copper, which rises to £288,000; and taking £32,000 for the other expenses, the capital expenditure is £320,000. If the annual expenses were £20,000, which seems impossible, the net income is £80,000 or 25 per cent.

3. Suppose the distance still 400 miles and all other things remaining the same, but only £50 being paid per annum for the horse-power; here we have still £320,000 of capital expenditure, and a net income of £30,000 for 1,000 horse-power delivered or 9 per cent.

Of course, it is understood that while cases can occur where these figures apply each case must be examined on its merits.

Looking at the last case quoted, the delivery of 1,000 horse-power at 400 miles, using 20,000 volts (or 200 miles with 10,000 volts), the financier would say 9 per cent. was not good enough for such a venture. I will now show how he may get 40 per cent., using the same machinery, the same copper and the same annual expenses. This leads me to say a few words to the great copper companies.

TO COPPER MERCHANTS.

I have now the pleasure to lay before you a simple financial transaction which copper merchants or others would willingly make, and which may avoid the huge capital hitherto required by those who would transmit the power, and will increase the dividends on money spent in the transmission. What I propose is to divide the capital account into two parts—ordinary stock which may be looked upon as speculative, and bonds on the copper which would be as sound an investment as could be desired.

Taking the last case mentioned, the capital charges are:

3,600 tons of copper at the extreme value of £75 a ton	£270,000
Putting in place at £5 a ton	18,000
Hydraulic and electric machinery, etc.	32,000
Total capital required	£320,000

Most of this capital is required for copper, which may be taken away if the company fails, and is an absolutely safe security.

The value of the copper is	£270,000
Cost of removal (uncalled capital)	18,000

On the £270,000 a mortgage may be raised, and 4 per cent. ought to cover the chances of a change of market value. Thus we have—

Annual payment on mortgage	£10,800

All we have done is to raise a mortgage on the best possible security. This might be done by the copper companies, who often have too much material in stock not paying interest, or the money could easily be obtained from independent capitalists. Let us now see what difference this has made upon the balance-sheet. The capital charges are:

Putting copper in place		£18,000
Hydraulic and electric machinery		32,000
		£50,000
Annual gross receipts—1,000 horse-power at £50		£50,000
Less annual expenses	£20,000	
Mortgage on copper	10,800	
		30,800
Annual net receipts		£19,200

or almost 40 per cent.

By this simple transaction we reduce the total capital required by the transmitters of power from £320,000 to £50,000 for 1,000 horse-power delivered, and we have increased the rate of interest from 9 per cent. to 40 per cent., which ought to satisfy most people.

This scheme I have laid before the manager of one of our largest copper companies, and he entirely approved of the general lines.

Before leaving this part of the subject, I wish to make it quite clear that none of the figures which I have given up to the present must be taken as applicable to every case that may arise; the cost of developing the power at a waterfall depends so much upon the height of the fall, accessibility, etc., that no kind of an idea can be given of the cost without some data to go upon. The costs used in the above calculation are over the mark for the most favorable cases and the cost of copper is also too high. Another factor is the size of the works. The larger the scale the smaller is the relative cost of works.

All that I have tried to make clear is that if there be a large and continuous demand for the power, and if the value of the mechanical power to the gold miner or others is great, the distance to which it can be transmitted with financial success is not limited to one or two hundred miles.

TO ENGINEERS.

Up to the present date financial men have not realized the value of long distance transmission. Engineers, too, have been so much engaged with electric lighting and traction that few have devoted much time to its study. The last nine years of my life have been devoted almost entirely to electric transmission and the last four years to very distant transmission.

At present there exist no printed tables for facilitating calculations, such as civil engineers possess in other branches of the profession. In the case of electric transmission, every engineer must prepare his own sets of tables and curves to work from. I have been compelled to work these out for myself in various units. In England we use miles, tons and pounds sterling. In America the units are 1,000 feet, the pound avoirdupois and the dollar. In Egypt the metric system prevails. The flow of water, too, must be taken in cubic feet per minute, gallons per day, meters per second, the Californian "miner's inch," or the New Zealander's unit, which is called a "head."

You will believe then that I possess a mass of tables and curves, and these might be worth publishing if the time had arrived, which is not perhaps yet. During these years, however, my methods have become so simplified that I venture to bring to your notice one curve in relation to the one special question of efficiency and cost of transmission lines. It is so simple in its present form through a gradual evolution that I cannot help thinking that it may be of use to others.

In transmission schemes the cost of copper becomes so all-important, when dealing with long distances, that it helps more than I can tell you to have simple means for estimating even roughly the cost and efficiency under various conditions.

I feel some diffidence in laying before you these methods because there is nothing new in the results, and all the results can be obtained by the ordinary methods. They have, however, been invaluable to myself. These methods are particularly useful for getting out preliminary estimates quickly.

Here let me say that in all preliminary work on the cost of long conductor lines I never take notice of the resistance of the conductor, nor of the value of the current. I deal only with the current density and loss of volts. It is the same thing under a different name. But it is what you want.

Again, I never use in calculations for my own use the efficiency of the conductor system. It is far more convenient to use the inefficiency or the reciprocal of the efficiency, which is also the horse-power put into the generating end of the line to deliver one horse-power at the other end.

I give you these suggestions for what they may be worth as the result of long experience.

I suppose everyone present is aware of the fact that if you had a case where the power cost absolutely nothing, you would use the least copper and have the cheapest arrangement, with an inefficiency of 2, i. e., an efficiency of 50 per cent., or 2 horse-power generated for each horse-power delivered. If

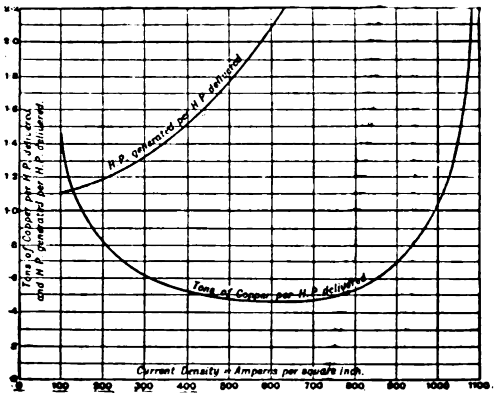


FIG. 1.

Electric Transmission Curve for 100 Miles at 10,000 Volts Continuous Current.

you make the current density either greater or less than what is required to produce this inefficiency, then you have to use more copper to deliver the same quantity of power.

This is a point which in a general way is appreciated by the business man who is not an electrician, as has been already stated.

Fig. 1 shows this very well, and a study of it is interesting. We see that the copper required to transmit 1 horse-power 100 miles at an initial pressure of 10,000 volts, with continuous current, falls with the increase of density until the efficiency is 50 per cent., and then rises. This figure shows the weight of copper required per horse-power delivered at a distance of 100 miles at 10,000 volts. It is drawn for the simplest case of continuous current, to which corrections only for temperature and sag have to be made. It is equally applicable to a single phase or two phase alternating transmission to 100 miles at 10,000 effective volts, or at 5,000 effective volts from any wire to the middle of the electric system, or to three phase transmission to 100 miles at 5,000 effective volts from any wire to the middle

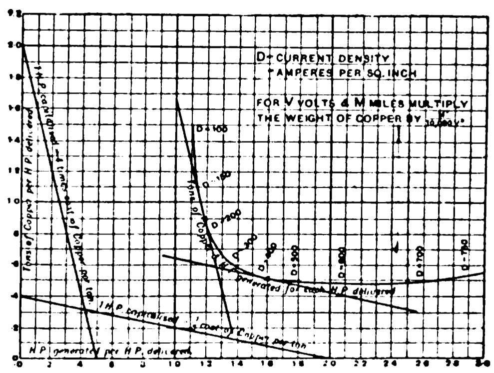


FIG. 2.

Electric Transmission Curve for 100 Miles at 10,000 Volts Continuous Current.

of the electric system. But with alternating current corrections must be made for self-induction and capacity.

The same remarks apply to the meaning of the voltage of the line in all the curves and tables referred to. They are worked out for continuous current, and for any other system the engineer must add the usual corrections.

Another curve may be drawn showing the inefficiency at each current density. This curve con-

stantly rises, i. e., the greater the current density, the greater is the inefficiency.

Now from these two curves we can deduce a third curve, which is the one which I find gives one in a few minutes all the main facts one wants for any horse-power to be delivered to any distance at any initial volts.

The curve gives the tons of copper per horse power delivered at 100 miles with 10,000 volts continuous current, in terms of the horse-power generated per horse-power delivered.

Measuring along a horizontal line you get the inefficiency, i. e., the horse-power generated for each horse-power delivered; and measuring vertically you get the corresponding tons of copper required for each horse-power delivered at a distance of 100 miles.

The curve is also marked with figures to show the current density in amperes per square inch section of copper.

I never travel a day without this curve in my pocket. This curve is correct for 100 miles and 10,000 volts or for any other case where volts equal 100 times the mile. The curve shows you, for example, that for an inefficiency of $1\frac{1}{2}$ you require a current density of 387 amperes per square inch, and .55 ton of copper. And thus current density and weight of copper per horse-power is the same whether you use 10,000 volts at 100 miles or 100 volts at one mile.

For any other volts and distances in miles, V and M, you divide the volts by the miles and get $\frac{V}{M}$; then $\frac{V}{100M} = D$, the multiplier for the current density, and $\left(\frac{V}{100M}\right)^2 = T$, the divisor, for the tons of copper per horse-power.

As an example, 15,000 volts and 300 miles. Here $D = \frac{15,000}{100 \times 300} = \frac{1}{2}$. Hence for an inefficiency as above of $1\frac{1}{2}$, the current density will be $\frac{1}{2} \times 387 = 193$. The tons of copper per horse-power will be $\frac{.55}{(\frac{1}{2})^2} = 2.20$ tons.

Now let me show another use of the curve. Suppose we capitalize the cost of running the generating station, and add to it the cost of the generating works, and divide by the horse power, we have then the capitalized value of 1 horse-power generated; I will call it for short the value of 1 horse-power generated. We also knew the cost of one ton of copper. Divide the value of the horse-power by the value of the ton of copper, and draw a line across the axes so that it cuts the axes in that ratio. Draw a line parallel to this and touching the curve. This gives you, according to Lord Kelvin's law (as modified by Ayrton and Perry), the point of maximum economy, giving directly the inefficiency, the tons of copper per horse-power and the current density. Thus on the curve two examples are shown, one where the value of 1 horse-power is four times that of a ton of copper. In this case the greatest economy is got by an inefficiency of 1.18, a current density of 180 amperes per square inch, and 0.91 tons of copper per horse-power delivered at 100 miles distance, the initial pressure being 10,000 volts.

Another example is shown on the curve where the horse power is one-fifth of the cost of a ton of copper.

The resulting values are seen directly to be: Inefficiency = 1.58; current density = 420; copper = 0.51 tons. To do this for other values of T $\left[T = \left(\frac{100M}{V}\right)^2\right]$ you must divide the value of the horse-power by T. Measure this distance vertically by the unit on the vertical scale or by fractions of these units, and measure the cost of a ton of copper horizontally by the unit on the horizontal scale or by the same fraction as before of that unit. Join the two points by a line and draw a parallel line touching the curve at the point of maximum economy.

You will see how valuable such a curve must be for obtaining the very information that an engineer requires in his first examination of any project. But we can do more than this. Divide the tons of copper per horse-power by eighteen times the distance in miles, and you get the sectional area in square inches of the conductors (go and return) per horse-power. Multiply this by the total horse-power to be delivered and you get the size of your conductors.

N. B.—Remember that this is all worked out for continuous current, and must be corrected for other systems as well as for temperature and sag.

Some people prefer to work by tables instead of by curves, so I will put down the readings of the curve which we have just been discussing. For ordinary work the following is sufficient:

Inefficiency.	Tons copper per HP.	Current density.
1.20	.86	190
1.30	.66	266
1.40	.58	330
1.50	.55	387
1.60	.51	432
1.70	.49	475
1.80	.48	510
1.90	.472	545
2.00	.470	574

In most practical cases, however, the economical inefficiency for long distance transmission lies between 1.20 and 1.50. The following table gives closer values over this range:

Inefficiency.	Tons.	Density.	Inefficiency.	Tons.	Density.
1.20	0.86	190	1.36	0.60	306
1.22	0.80	207	1.38	0.59	319
1.24	0.76	221	1.40	0.58	330
1.26	0.72	236	1.42	0.57	342
1.28	0.69	250	1.44	0.56	354
1.30	0.66	266	1.46	0.55	365
1.32	0.64	279	1.48	0.54	376
1.34	0.62	292	1.50	0.53	387

From either of these tables, having given the inefficiency, to get the density for any volts and distance, multiply the above value by $\frac{V}{100M}$, and to get the tons of copper divide the above value by $\left(\frac{V}{100M}\right)^2$

This little table enables us then, with a very simple piece of arithmetic, to get the result for any case that may arise, sufficiently close.

But in actual practice I find it far more useful to have the table extended in such a way that an approximate result may be arrived at without any calculation.

Three tables are here given. The first gives a reference letter for any volts and distance. In the second and third tables the results we want are found under that reference letter. The second table gives the tons of copper per horse-power delivered, and the third gives the current density for any inefficiency that we may select.

TABLE I.—DISTANCE OF VOLTS.

Virtual Volts between Wires.						
One or two phase..	5,000	10,000	15,000	20,000	25,000	30,000
Three phase	4,325	8,650	12,975	17,300	21,625	25,950
Distances in Miles.						
A........................	12.5	25	37.5	50	62.5	75
B........................	25	50	75	100	125	150
C........................	37.5	75	112.5	150	187.5	225
D........................	50	100	150	200	250	300
E........................	62.5	125	187.5	250	312	375
F........................	75	150	225	300	375	450
G........................	87.5	175	262.5	350	437.5	525
H........................	100	200	300	400	500	600
K........................	150	300	450	600	750	900

RULES FOR USING THE TABLES.

Rule I.—To find the reference letter.—In Table I, in the column referring to the volts generated, find the approximate distance of transmission in miles. The capital letter at the beginning of the line in which this is found is the reference letter.

TABLE II.—TONS OF COPPER PER HORSE-POWER DELIVERED.

Inefficiency.	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
A..............	.0537	.0412	.0362	.0344	.0319	.0306	.0300	.0295	.0294
B..............	.2150	.1650	.1450	.1375	.1275	.1225	.1200	.1180	.1175
C..............	.4337	.3725	.3262	.3091	.2869	.2756	.2700	.2655	.2644
D..............	.8600	.6600	.5800	.5500	.5100	.4900	.4800	.4720	.4700
E..............	1.344	1.031	.9062	.8591	.7969	.7656	.7500	.7375	.7344
F..............	1.935	1.499	1.305	1.287	1.148	1.102	1.080	1.062	1.053
G..............	2.634	2.020	1.776	1.684	1.562	1.504	1.470	1.446	1.439
H..............	3.440	2.640	2.320	2.200	2.040	1.960	1.920	1.888	1.880
K..............	7.740	5.940	5.220	4.9[illegible]0	4.590	4.410	4.320	4.248	4.230

TABLE III.—CURRENT DENSITY.

Amperes per square inch.

Inefficiency	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
A..............	760	904	1,320	1,448	1,728	1,900	2,040	2,180	2,296
B..............	380	452	660	724	864	950	1,020	1,090	1,148
C..............	253	301	440	515	576	633	680	727	765
D..............	190	226	330	387	432	475	510	545	574
E..............	152	181	264	310	346	380	408	437	459
F..............	127	151	220	258	288	317	340	368	383
G..............	108	129	188	221	246	271	292	311	327
H..............	95	113	165	193	216	237	255	272	287
K..............	63	75	110	129	144	158	170	182	191

Rule II.—To find the tons of copper per horse-power delivered.—Look along the row in Table II referring to the reference number, and tons of copper are there given for each inefficiency. The inefficiency being the horse-power generated to deliver the horse-power at the distant point.

Rule III.—To find the current density.—Table III gives this in amperes per square inch in the row corresponding to the reference number, and in the column corresponding to the inefficiency chosen.

Rule IV.—To find the economical conditions of working (Kelvin's law).—Divide the capitalized value of 1 HP. by the cost of one ton of copper. Divide this by 10 and call it q. In Table II look along the row corresponding to the reference letter until the difference between successive numbers is approximately q. The number at the head of that column is the economical inefficiency, the tons are also then

given, and the current density is obtained directly in Table III.

Rule V.—To find the total section (go and return) of all the transmission conductors.—Multiply the tons per horse-power by the total horse-power, and divide by 18 times the distance in miles. This is the result in square inches. Dividing this by the number of conductors gives the sectional area of each.

I trust that I have not wearied you with these arithmetical conundrums. All I can say is that I have found them of the greatest use, and I shall be very pleased if some of you do also.

I trust that all here present who are not engineers realize now that the cost of transmission of electric power to a distance is a pure question of balancing expenditure and profits. By the methods now described, or by the ordinary methods, there can be no question as to the cost of the work. The only point in fact affecting the cost which has been left to the choice of the engineer is the electric pressure to be used, and every engineer in reporting on a scheme generally gives his reasons for selecting the pressure. In old days the highest pressure for which we could get a guarantee from contractors was used. But the expense of insulation was increased so much with increase of pressure that now, as at Rheinfelden, we work to that pressure which is the most economical. Manufacturers will now guarantee any pressure if you will pay for it.

Having now determined with sufficient accuracy the cost of the works and their maintenance, annual expenses and interest on mortgage, the next thing is to see (or perhaps this ought to be the first matter attended to) what return can be obtained for the power delivered to a distance. It is then for the purely financial men to say whether the profits to be derived are worth the venture.

It has been my object to-night to put before engineers some useful rapid methods for arriving, on the ordinary lines of working, at the data for any special case of long distance transmission of power. It has also been my object to show that those who carry out such schemes do not require to be handicapped by the enormous capital which has hitherto been generally considered necessary. Incidentally it would appear that whenever gold mines exist which can afford to pay 5s. or 6s. per ton of ore milled, and if there be good water power within 400 miles of the mines, it is most probable that it will pay well to transmit the power electrically.

If I have convinced any doubters that simply in my limited experience I have found many cases where it will pay well to transmit power to distances of several hundred miles, then my purpose is served, and I shall be glad that I have brought this subject to your notice.

The Rays of the Glow-Worm.

The pale green light that shines from the so-called "glow-worm" is said to be due to the emission of X-rays. It is claimed by some that this creature is not a worm at all, but the wingless female form of a species of beetle, the *Lampyris noctiluca*, and her luminosity is supposed to afford the means of attracting the non-luminous male. Recently 300 of these insects, according to the *Revue des Sciences*, were made the subjects of experiment by enclosing for two days in a dark chamber, sheltered from all foreign lights, and placing before photographic plates screened by several thicknesses of black paper, besides plates of brass, copper, and aluminum; also a piece of cardboard, with a hole in it, was interposed between the plates and the photographic plate. On developing the latter, it was found to be blackened, except at the part opposite the hole in the cardboard. The rays of the *Lampyris*, therefore, appear to have penetrated the metal and excited luminosity in the cardboard. It was subsequently discovered, also, that when there was nothing between the sensitized plate and the "worm" the rays acted as do those from ordinary light, but in traversing cardboard and certain metals they acquired the properties of the Roentgen rays. It is suggested that possibly these creatures have the property of emitting both forms of rays.

TRANSMISSION OF POWER BY ELECTRICITY.*

(*Concluded from page 344.*)

The actual expenses during 1897 in connection with the boilers, pumps and condensers were £8,746. and include coal, carting the same and the ashes, trimming coal and stoking boilers, washing, cleaning and attending boilers, condensers and economizers, supervision, repairs, gas, sundry stores, 10 per cent. depreciation and 5 per cent. interest.

The present staff to work five return tube and two Babcock & Wilson boilers consists of one chief stoker, five stokers, one trimmer and one boy.

For the engine department the total expenses were £1,648, comprising the wages of the engine room staff and of occasional help from the yard department, supervisions, repairs, stores, 10 per cent. depreciation and 5 per cent. interest.

The engine room staff consists of three engine drivers, two dynamo attendants, and three electrical assistants, whose time is not wholly taken up with central station work.

In these charges no account is taken of the water, most of which is used in the india-rubber department before it is transferred to the boilers. The total amount spent on such water was £234 for the year 1897, and one-third, or £78, should be charged against electricity.

According to these figures the actual cost of electricity was, in 1897—

Expenses in boiler department	£1,873
Expenses in engine department	1,648
Expenses for water	78
Rent, taxes, insurance and salaries	220
1,178,286 B.T.U., total cost	£6,319

or 1.287d. per B. T. U., or 0.69d. per electrical horse power at the switchboard of the station.

For the maintenance of the cables no expenses at all were incurred, but for depreciation and interest 7½ per cent. should be charged on the capital outlay which was in round figures £3,000.

In connection with the motors the expenses were £2,063, comprising repairs, stores, labor, 10 per cent. depreciation and 5 per cent. interest.

A further charge on the motive power is the 5 per cent. loss in the conductors, and 10 per cent. loss in conversion from electrical into mechanical energy.

Taking all these figures together, we arrive at the total cost of motive power during the year 1897, viz., £9,900, or 2d. per B. T. U. at the terminals of the switchboard, and 1.7 per brake horse power per hour exerted by the motors.

It is not pretended that these results are the best obtainable; they may, however, be utilized for drawing

SOME GENERAL CONCLUSIONS

which apply to transmission of power by electricity generally.

For this purpose the total of £9 900 has to be subdivided under the heads:

A.—Standing Charges.—Depreciation, interest, payment of rates and taxes, rent, general charges and loss in conductors and conversion.

B.—Fuel.—Coal and carting the same.

C.—Labor and Supervision.—Actual wages paid in connection with boilers, engines and motors, also part of foreman's wages.

D.—Stores.—Mainly oil and waste, also water; the charge for the latter is, however, exceptionally low as explained above.

E.—Repairs.—The charges of the fitters and other departments for work done.

Arranged under these heads the total charges for the brake horse power given out by the electric motors are:

A.—Standing charges, £4,869 or 49.1 per cent.
B.—Fuel, £2,654 or 26.8 per cent.
C.—Labor, £1,183 or 12.0 per cent.
D.—Stores, £595 or 6.0 per cent.
E.—Repairs, £599 or 6.1 per cent.
Total, £9,900 or 100 per cent.

This shows that, roughly speaking, the standing charges account for half the expense, fuel for a quarter, labor for one-eighth, and repairs for one twentieth, the stores making up the total.

In addition it should not be overlooked that the cost of conductors and the loss of energy in them is naturally low, as the motors are comparatively close to the central station.

Wherever they are far apart the standing charges would preponderate still more.

Of the 49.1 per cent. charged as standing charges, 36.1 per cent. are unvarying, while 13 per cent. represent loss in leads and in conversion, and these will increase with an increasing output.

For instance, if the output of this particular plant were doubled so that the load factor would be .38, the expenses would be for, say, 2,400,000 B. T. U.:

Standing charges, £6,162, equals 38 per cent.
Fuel, £5,308, equals 32.65 per cent.
Labor, £2,366, equals 14.60 per cent.
Stores, £1,190, equals 7.35 per cent.
Repairs, £1,198, equals 7.40 per cent.
Total, £16,224, equals 100 per cent.

This is equal to 1.62d. per B. T. U. at the terminals of the switchboard, or just under 1.4d. per brake horse power per hour given out by the motors.

Of the standing charges 22 per cent. represent depreciation and interest, while 16 per cent. cover the losses in leads and in conversion.

A comparison between these two results shows again the importance of increasing the load factor to diminish the expense per unit of work done, or, in other words, if power is to be transmitted by electricity it is above all things necessary to use it as constantly as possible.

Conversely if in any particular instance power is wanted only at intervals and for short periods, it can safely be assumed that no economy can be effected by introducing transmission of power by electricity.

Similar considerations determine for the workshop whether it is more advantageous to drive a particular machine by its own electric motor, or whether it is more economical to group a number of machines together, driving them by belts from a shaft to which an electrical motor is attached.

Bearing in mind the property of electric motors of not absorbing more current than the load at each moment demands, and their high efficiency even at one-quarter of the full load, it will in most cases be possible to group machines together, especially smaller ones, as the cost of a counter-shaft and belting is in such cases less than the difference in the cost of one large motor and several smaller ones with all their accessories.

The most useful field for electric motors in workshops is without doubt their application to movable machinery such as cranes, travelers and drilling tools, a description of which need not be entered into.

Next to the importance of having constant work for the plant is the question of fuel consumption. Besides using the most economical boilers and engines the site of the power plant should be selected so as to secure the fuel at the lowest possible cost.

Whether water power would be cheaper than steam cannot be decided for all cases, as the answer depends on the amount of capital outlay required to secure an adequate supply of water at all seasons of the year, further, on the price of coal and other well known considerations.

At any rate it is very remarkable how very few localities can be found where a sufficient water supply may be depended upon all the year round.

An obvious solution of the problem, how to obtain cheap fuel, is evidently to erect the plant for generating electricity close to a coal mine, and to distribute power to the various works which usually are found in the neighborhood.

Such an installation has been erected at Brakpan,

* A paper read by Alexander Siemens before the British Association for the Advancement of Science.

in the Transvaal, and the electricity is conveyed from there along the Witwatersrand to various mines and railway stations up to Johannesburg, which is about 30 kilometers (19 statute miles) distance from Brakpan.

The generating plant was erected near a small lake, so as to secure water for condensing purposes all the year round, about 3 km. (2 statute miles) from a coal mine, with which it is connected by a private railway line, and all the latest improvements in the shape of mechanical conveyors and stokers were adopted to reduce the price of the fuel and the cost of labor.

Besides a separate plant for supplying all the auxiliary motive power and the station lighting, the works contain 4 main steam dynamos of 1,000 horse power each, that deliver three phase currents at 750 volts to transformers which raise the pressure to 10,000 volts.

The currents then enter the overhead main line of conductors, which is altogether about 40 km. (25 statute miles) long and has branches to the various mines, as circumstances require.

Each conductor consists of two bare strands of copper wire, each 70 sq. mm. in section, and elaborate precautions have been adopted to prevent these six strands from falling to the ground and from coming in contact with other wires crossing the main line.

Some trouble was experienced to protect the system against lightning, and it has been necessary to construct special apparatus before this difficulty could be overcome.

At the various mines transformers reduce the pressure of the current according to the purposes for which it is to be used, and they employ motors, varying in size from 1.5 horse power to 250 horse power.

In the month of July, 1895, the works at Brakpan were commenced, and on the 27th of January, 1897, the first steam dynamo commenced working. Since then the works have steadily been added to, but the data as to cost can obviously not be taken as a guide for other cases, as the regular working of the full plant has not yet settled down properly.

A somewhat similar system of distributing power over a district has been in operation near Waldenburg in Silesia for the last two years.

In this case the generating plant has been erected at the pit mouth, and it consisted at first of four steam dynamos each of 300 horse power, two of which produced three phase currents; the third, continuous currents to work a tram line about 22 km. (14 statute miles) long, while the fourth steam engine is coupled to one three phase and one continuous current dynamo serving as a stand-by for both systems.

For a radius of 4 km. (2½ statute miles) the three phase current is distributed at a pressure of 3,000 volts, at which it is generated, but for greater distances the current is transformed up to 10,000 volts.

Owing to the success of the enterprise two large three phase generators of 1,000 horse power are to be added as soon as they can be completed, and six more of the same size will be taken in hand in the near future.

The charge to the public for electricity is, in the district receiving current at 3,000 volts:

For lighting purposes, 50 pf. (equals 6d.) per B. T. U.

For motive power and heating, 15 pf. (equals 1.8d.) per B. T. U.

In the places supplied by the 10,000 volt currents the charges are 20 per cent. higher, but large consumers receive a discount according to the amount of current they use, amounting to 35 per cent. in cases where the value of current taken exceeds 10,000 mk. (£500) per year.

At these prices the 1,200,000 B. T. U. used in 1897 at the Siemens Brothers works at Charlton would have cost about £7,000, even if the higher prices of the 10,000 volt district had been paid.

It is characteristic of this country that these examples of transmission of power by electricity over a large district had to be taken from foreign practice.

However enterprising and progressive the individual Englishman is, when a novelty can be introduced only by the co-operation of a municipality, of a county council, or worst of all, of Parliament, everybody appears to consider it a patriotic duty to throw obstacles in its way, and in most cases it is quite impossible to find out who benefits by such action.

After a while the public discovers that the introduction of the novelty would be a great convenience, and an agitation is set on foot to remove the obstacles which were, in many cases, introduced only to satisfy prejudices.

Let us hope that a similar fate will not befall the transmission of power by electricity.

LONDON NOTES.

[From our London Correspondent.]

An Anglo-Cuban Cable Company and the War.

The Cuba Submarine Telegraph Company, Limited, seems to have been the gainer to a considerable amount by the lately concluded war, for its gross income increased to £33,504 for the first half of this year as compared with only £23,623 in the corresponding period of 1897. The chairman of the company has just paid a tribute to the splendid behavior of the staff in very trying times. The American censorship over the Western Union cables compelled the Spanish authorities at Havana to send their cable messages via Santiago and Jamaica, causing the increase in receipts mentioned. The American authorities then set to work to isolate Cuba as far as possible from the outside world and also to separate each chief town from the other where cable communication existed. Many of the Cuba Submarine Company's cables were cut, and their cable hut at Cienfuegos was entirely destroyed by the bombardment of the American fleet. The staff kept to their posts well, and the company was able to maintain communication from Havana and Jamaica right through the war. When the Americans entered Santiago they were greatly surprised to find the company's cables still working. The cables were sealed up, stopping the through traffic for about three months. The board is making claims on the American Government for the various expenses incurred by damage, etc.

Accumulator Omnibus at Berlin.

According to the *Electrical Review*, London, an omnibus has just been put on the streets of Berlin having a seating capacity of 20. It has a length of 7 meters and weighs with its battery of accumulators 6,650 kgs. The battery consists of 24 boxes, each containing five elements, and its total weight is 1,700 kgs., three-quarters of which is supported by the front axle which is the motive axle. The speed is 6 to 12 km. an hour, and the battery has to be recharged after a run of 60 km. At starting a current of 50 amperes at 225 volts is required; at a mean speed 35 amperes are sufficient, and 40 amperes are required for the maximum speed.

A Virginia Street Railway and Electric Association.

The Street Railway & Electric Association of Virginia was organized at Richmond on the 6th inst. with these officers: R. D. Apperson, president; E. R. Williams, vice-president; H. P. Woodson, secretary and treasurer.

The companies represented at the meeting were: Lynchburg & Rivermont, City Street Car Company of Staunton, Roanoke Power Company, Richmond Traction Company, Norfolk Street Railway Company and Norfolk & Ocean View Railway Company.

The object of the Association is the acquirement of scientific, experimental and other information in regard to street railway and electrical progress.

SOCIETY NEWS.

New York Electrical Society.

The 192d meeting of this Society will be held at the College of the City of New York, Lexington avenue and 231 street, on Wednesday, Dec. 14, at 8 P. M.

Col. Eugene Griffin, Colonel of the First Regiment of U. S. Volunteer Engineers and First Vice-President of the General Electric Company, will give an address on "Ideas Underlying the Organization of the Volunteer Engineer Corps; the Work Accomplished by it in Porto Rico, and the Opportunities of Further Usefulness."

Mr. W. D. Weaver, late Chief Engineer of U. S. S. "Glacier," Editor of the *American Electrician*, and Mr. F. W. Roller, late Chief Engineer U. S. S. "Nashville," will also address the Society on "Electrical and Engineering Work in the Navy during the War."

In this manner the relations of the engineering profession to both the Army and the Navy will be clearly brought before the members of the Society, and it is believed that the occasion will prove one of much general interest and value.

The meeting is open to ladies.

Special Meeting of the American Society of Civil Engineers.

At a special meeting of the above society to be held at 220 West 57th street, New York, this (Wednesday) evening, Hiram S. Maxim, M. Am. Soc. C. E., will deliver an illustrated lecture, in which the apparatus used in his experiments concerning artificial flight will be described and the evolution of the automatic gun illustrated. Slides showing the gunshops, etc., will be shown. A small Maxim gun will also be exhibited and fired with blank cartridges. Members are invited to attend and ladies will be welcome.

Exports of Electrical Material from New York.

The following are the exports of electrical material from the port of New York for the week ending December 6:

Alexandria, Egypt—6 cases, $947.
Argentine Republic, 6 packages, $481.
Australia—23 packages, $376.
Berlin—3 cases, $60.
Brazil—101 packages, $912.
Bremen—6 cases, $500.
British Possessions in Africa—10 cases, $280.
British East Indies—11 cases, $280.
British Guiana—27 packages, $650.
Cuba—9 packages, $113.
Central America, 1 case, $160.
Ecuador—1 case, $34.
Florence—1 case, $50.
Glasgow—18 cases, $1,438.
Hamburg—85 cases, $6,646.
Havre—68 cases, $2,741.
Helsingfors—8 cases, $500.
London—299 packages, $19,434.
Liverpool—8 packages, $1,893.
Leeds—11 cases, $367.
Mexico—40 packages, $1,837.
Milan—28 cases, $11,400.
Manchester—3 cases, $110.
Moscow—8 cases, $428.
Newfoundland—7 cases, $125.
Naples—5 cases, $255.
Oporto—36 cases electric motors, $5,600.
Preston—1 package, $10.
Stockholm—1 case, $386.
St. Petersburg—17 packages, $623.
Southampton—20 cases, $360.
U. S. of Colombia—4 cases, $300; 2 packages, $17.
Venezuela—7 cases, $227.

THE ELECTRICAL EXHIBITION COMPANY.

At a meeting of the Board of Directors of the Electrical Exhibition Company, held this day, Mr. H. L. Shippy was elected a director and vice-president in place of Mr. F. W. Roebling who resigned.

MARCUS NATHAN, General Manager.

New York, Dec. 7, 1898.

MADISON SQUARE GARDEN LEASED.

Mr. C. O. Baker, Jr., President of the Electrical Exhibition Company, has signed a lease of the Madison Square Garden for another Electrical Show to be held during May of next year under the auspices of and in connection with the 22d Convention of the National Electric Light Association. Although the last show occurred in May when the war interest was most intense it drew large crowds of people. Electrical development is so rapid nowadays and the newspapers have described so many of the newer and more wonderful inventions, that an exceedingly interesting and successful show is looked for. The officers of the Electrical Exhibition Company are: C. O. Baker, Jr., president; H. L. Shippy, vice-pres.; Geo. F. Porter, secretary and treasurer; Marcus Nathan, general manager; H. H. Harrison, L. F. Requa, J. W. Godfrey and C. Lieb, directors.

CANADIAN NOTES.

Notice is given on behalf of the Quebec, Montmorency & Charlevoix Railway that application will be made at the next session of the Dominion Parliament for an act amending the act incorporating the railway in the following particulars: To change the name of the company to the Quebec Railway, Light & Power Company; to ratify the purchase of the property and franchise of the Quebec District Railway Company by deed passed at Quebec on the 29th of June, 1898, the issues of bonds and stock made for the purpose of paying the purchase price thereof, and to authorize the company to build a line of railway or tramways in the counties of Levis, Bellebasse, Dorchester, Beauce and Lotbbiniere; to ratify the purchase of the property, works, plant, buildings, machinery and capital stock of the Montmorency Electric Power Company, and the issues of bonds and stock made by the Quebec, Montmorency & Charlevoix Railway Company in connection with purchase.

Owing to the small number of tenders received by the city council of Toronto, Ont., for the installation of a municipal electric light plant, it has been decided to accept none of the tenders. From the tenders submitted it was found impossible to arrive at even an approximate cost of an electric plant. No tenders were received from Canadian manufacturers. In this connection the Anglo-American Electric & Supply Company have made a proposition to supply electric energy to the city. Power is offered at cost after paying a dividend of 10 per cent. to the shareholders upon a capital stock of $5,000,000. It is guaranteed that the cost to the public will not exceed one cent per horse power per hour.

Mr. J. Geo. Gardner, of Baltimore, Md., has been in Ottawa with a view to ascertaining the commercial value of the experiments made in the manufacture of calcium carbide. He examined the carbide which he saw manufactured from the Emerson process, and after experimenting with it was pleased to discover that slag and other impurities were wholly absent from the carbide produced from sawdust. It is said that Mr. Gardner is empowered to purchase the product of Mr. Emerson's plant in case Ottawa, the most favorably situated location known in regard to natural and artificial conditions, will undertake the manufacture of this article of commerce.

LEGAL NOTES.

Justice Collins of the Supreme Court at Trenton, N. J., on the 5th inst., filed an opinion upholding the constitutionality of the "Squire" trolley law, under which the Elizabeth City Railroad Company received a franchise to build an electric railway between Elizabeth and Plainfield. The company is controlled by ex-Congressman John Kean, who made the highest offer ($250,000) for the franchise. The law was attacked on the ground that it was special legislation, but the Supreme Court overruled every objection.

James H. Cluggage, who agreed to light the town of Sullivan, Ind., by electricity for $50 a year for each arc light furnished, gave up the job after two months' trial. The town made a new contract with other parties at $63 a year for each light and sued Cluggage and his bondsmen for the difference in price. The Circuit Court held in favor of the defendants, but the Appellate Court has reversed its judgment, holding that they had not presented a sufficient defense to the action.

The suit of the Fountain Head Railway Company against J. Simpson Africa, trustee, and the Knoxville Street Railway Company, which is now known as the Knoxville Traction Company, was decided in the Circuit Court at Knoxville, Tenn., a few days ago. The roads had entered into a contract in regard to the use of tickets. This contract was to last for twenty years, and the first of the two parties who should violate the same was to forfeit to the other party $10,000. Just before the Knoxville Street Railway Company was reorganized as the Knoxville Traction Company the contract was broken by the Knoxville Street Railway Company, and the Fountain Railway Company brought suit for $10,000 for breach of contract. The decision secured in Judge Sneed's court gives the Fountain Head Railway Company a verdict for $10,000, and the amount of damages claimed under the contract.

At Kokomo, Ind., on the 1st inst. Judge Brownlee, of the Superior Court, rendered a decision in the electric light receivership case, to the effect that necessary current expenses incurred before the appointment of a receiver are preferred to the mortgage lien existing in favor of the bondholders. The decision is based on the idea that an electric light company is a quasi public corporation, and the discharge of its duties is of public interest, and that if current expenses are not provided for it would be to the detriment of the public. Money since collected and expended on the plant should have been applied to the indebtedness of the former current expense.

Proposals Invited.

The Chief of the Bureau of Yards and Docks of the U. S. Navy Department is inviting sealed proposals until December 23 for enlarging the electric light and power plant at the Boston Navy Yard. Bids will also be opened on the same date for extending the wiring system at the same yard. Specifications, blank forms of proposal, a general plan and a wiring plan will be furnished intending bidders upon application to Mordecai T. Endicott, Chief of Bureau, Washington, D. C., or the Commandant of the Boston Navy Yard. Bidders are expected to inform themselves of the character of the work by visiting the navy yard.

The U. S. Treasury Department is inviting sealed proposals until December 27 for installing a system of iron armored conduits or cold drawn steel tubing with interior non-corrosive lining, wiring and distribution tablets in the United States Post Office building at Paterson, N. J. Plans and specifications may be had upon application to the Department.

The Bureau of Supplies and Accounts of the Navy Department is inviting sealed proposals until December 20 for furnishing the Navy Yard at Portsmouth, N. H., with one steam engine and one direct current dynamo. Specifications, blank forms of proposal, and all necessary information will be furnished upon application to the Navy Yard at Portsmouth, or to the Bureau at Washington, D. C.

THE NEWS.

What is Going On in the Electrical World.

STREET RAILWAYS.

Akron, O.—The officials of the Akron, Bedford & Cleveland electric road state that the road is to be double-tracked at once between Cuyahoga Falls and Newburg. When this is done there will remain not more than two miles of single track on this road and this strip will be doubled next summer.

Belfast, Me.—James Mitchell, the Portland railroad contractor, expects to begin in the spring the construction of an electric road between Belfast and Northport camp ground. This will be one of the sections of the long looked for trolley line between Bangor and Rockland.

Bound Brook, N. J.—The borough council has passed the ordinance granting a franchise to the New York & Philadelphia Traction Company on East street to the Somerset county line. This grant will enable the company to complete its system.

Clinton, Mass.—Many business men of Clinton with money to invest are talking seriously of the feasibility of constructing another electric railway from Clinton to Worcester. The plan is not intended to interfere with the successful operation of the new Worcester & Clinton line, which is approaching completion, but the object is to provide cheap and convenient transit to Sterling camp grounds and as a pleasure trip around the great Wachusett basin.

Dayton, O.—Col. Fred Colburn, president of the Dayton, Springfield & Urbana Electric Railway Company, has filed a bond of $20,000 as a guarantee to the city that the road will be completed within the time specified in the franchise. Work has already begun at Springfield.

Frankton, Ind.—At a meeting held here by the promoters of the Hartford City and Indianapolis electric road, the reports of several township committees along the proposed route were read. They were very encouraging, and it now seems that enough money will be pledged by the different townships to make the road a certainty. It was decided to run the line through Lapel, instead of Noblesville, as was originally intended, down White river to Perkinsville, and thence across the country to Indianapolis.

Marshall, Tex.—C. J. Randall of Shreveport contemplates building a mammoth hotel at Hinson Springs, six miles west of this city, and also an electric railway from this city to the springs.

Mount Vernon, N. Y.—The common council has granted the New York, Westchester & Connecticut Traction Company a fifty years' franchise over twenty miles of the streets and avenues of this town. This company, in connection with the People's Traction Company of New York, which holds franchises in the borough of Manhattan, is said to be controlled by the Nassau Electric Company of Brooklyn. The traction company has furnished a bond of $25,000 as a guarantee that they will have the road in Mt. Vernon completed and in operation on or before August 2, 1899.

New Castle, Pa.—A party of engineers has been in this vicinity several days making the survey for a new street car line that is to run from New Castle to Youngstown, O The application for the charter has already been made for the line from New Castle to the State line.

Philadelphia —The Union Traction Company has decided to equip all its lines with larger cars in order to provide more adequate accommodation for its patrons.

Radford, Va.—Judge Cassell, of the Hustings Court of this city, has confirmed the sale of the Radford street car line to Mrs. Ella M. Crockett for $3,505.

St. Louis.—A deal has been closed by which the Southern Electric Railway Company of this city, for a consideration of $3,500,000, has become the owner of all the lines and equipment of the National Railway Company, better known as the Hamilton syndicate. The property includes the Northern, Central, Cass Avenue & Fair Grounds, Union, Citizens, Baden and Southwestern lines, all electric, and the St. Louis line, or Broadway cable. They represent 95.04 miles of track, of which 80.37 miles are electric and 14.67 miles cable. Following this sale comes the announcement of the sale of the entire Lindell system to a syndicate represented by the New York ba king firm of Brown Bros., for $8,500,000. A few weeks ago the Lindell Railway Company had the life of its franchise extended for fifty years, after a bitter fight in the council, the mayor signing the bill over the protest of many prominent citizens. It looks now as if the entire street railway interests of St. Louis will soon be under the control of a single corporation.

Toledo, O.—The Detroit & Wyandot electric road, now in operation between Detroit and Wyandot, has been purchased by T. C. Hutchins and A. B. Du Pont of Detroit, and it is understood that the road will be extended from Wyandot to Toledo, making a continuous trolley road between Toledo and Detroit.

Washington, D. C.—The car shed of the Eckington & Soldiers' Home Railway, at Fourth and T streets northeast, was destroyed by fire on the night of the 3d inst. Ten double deck observation cars, valued at $2,000 each, were burned. The total loss is estimated at $65,000. The

property burned was not long ago acquired by the new City & Suburban Railway Company, together with the other equipments of the old Eckington & Soldiers' Home Railway Company.

Williams Bay, Wis.—The proposed electric railroad from Harvard, Ill., to the head of Geneva Lake is now almost certain to be built. H. N. Bates, general manager of the Continental Construction Company of Boston, has offered to build and equip the road and have it in operation by June next.

Wilmington, Del.—The Wilmington & Brandywine Springs Electric Railway was formally opened on the 8th inst. The line extends from Wilmington into the country about six miles, and has its terminus at Brandywine Springs, a picturesque spot on the Red Clay Creek. At Brandywine Springs a pleasure resort will be started and opened next summer. The Wilmington & Elsemere Electric Railway on the 8th inst. passed into the hands of its new owners, who also own the Wilmington & Brandywine Springs Railway. The new owners organized by electing the following officers: President, R. W. Crooks, of Brandywine Springs; secretary and treasurer, Dr. L. H. Ball, of Faulkland; directors: Mr. Crooks, Dr. Ball, F. L. Barry and John Dobson of Philadelphia, and William S. Hilles of Wilmington.

LIGHTING.

Bellevue, Pa.—A. M. Voight, representing the Pennsylvania Light, Heat & Fire Company of Allegheny, asked the council that a franchise be given his company to furnish light, heat and fire in this borough. He offered to pay the borough 2 per cent. of the gross receipts. The company has been organized to utilize the waste electric power of the United Traction Company for lighting, heating and cooking purposes. It is intended to build a plant on the Ohio river front.

Chestertown, Md.—The electric light company has accepted the offer of the town commissioners and agrees to furnish and maintain eighty thirty-two candle-power incandescent lamps for the sum of $12.50 per year each.

Chicago.—A dispatch from Wabash, Ind., to the "Inter-Ocean" states that "information of a big combination of electric light plants in twelve Northern Indiana cities was given out on the 4th inst. The project includes the transfer to a company with $1,000,000 capital of all the property and franchises of the companies, options amounting to nearly $500,000 having been secured on the systems. Another $500,000 will be expended in providing for supplying electricity for power on a gigantic scale. In addition to the leading stockholders of the local companies the company will include P. J. Sorg, the millionaire tobacco man of Middletown, O.; Fletcher Heath of Hamilton, O., and banking interests at Indianapolis and New York. The organization will be completed in New York about January 1."

Danville, Ill.—The Danville Electric Light Company has backed out of its proposition to light the city at the rate of one dollar a light per year provided it was given the exclusive right to furnish electric lights within the city.

Hagerstown, Md.—The council has passed an ordinance providing for the issue of $60,000 of bonds for the erection of an electric light and power plant.

Hastings, Neb.—Denver parties are in Hastings for the purpose of organizing a company to purchase the present electric light plant. It is proposed to make it one of the best plants in the West.

Ilion, N. Y.—A movement is on foot to allow the taxpayers of this village to express their wishes by ballot at the next charter election either "for" or "against" instituting an electric light plant to furnish arc and incandescent lights for streets and domestic purposes, to be owned and operated by the village. The present arc system is owned by the Herkimer County Light & Power Company, who have given good service. The action of adjacent villages to own and maintain their own system of lighting has caused the agitation of this question in Ilion.

Indianapolis, Ind.—Daniel A. Chenoweth, promoter of the Chenoweth Light & Power Company, with his application for a lighting franchise in this city filed a bond of $25,000 as a guarantee. The company will cater only for that part of the city outlying the territory bounded by North, West, South and East streets.

Lincoln, Ill.—Some leading residents of Lincoln, together with Henry G. Herget and W. J. Conzelman of Peoria, intend to erect and equip a first-class electric light plant to supply public and commercial lighting. The company, which will be known as the Logan County Electric Light Company, has a paid up capital of $10,000.

Marquette, Mich.—This city is to be made the scene of a Government experiment in illuminating its lighthouses and breakwaters on the lakes by means of electricity. The experiment will be tried here in the course of a week or two, and if it is successful kerosene will be superseded by electricity all over the great lakes where the new illuminant is obtainable. A submarine cable will be laid to the lighthouse on the extreme end of the breakwater in the lower harbor.

Middleport, N. Y.—The trustees have advertised for bids for furnishing electric lights for the streets, etc. If the prices are low enough a five-year contract will be made with the successful bidder. Bids will be received until the 14th inst.

New Orleans, La.—Another electric company has been organized here and is said to have contracted with the Western Electric Company of Chicago for the construction and equipment of the entire plant. The new concern is the Merchants' Electric Light & Power Company, and its officers and directors are: President, M. Ber; vice-president, Joseph Simon; secretary, treasurer and general manager, E. W. Goldschmidt; directors: C. D. Crandall, A. McEwen, Julian Cohn, E. H. McFall and E. W. Goldschmidt. The company is operating under the Cohn and Ber franchise.

Paulsboro, N. J.—The Business Men's League of this place has started a movement for the purpose of having the town lighted by electricity.

MANUFACTURING, ETC.

Binghamton, N. Y.—Parties reported to be representatives of an international syndicate, and one of whom is an electrical engineer of New York, have been selecting a site for a large factory to be erected here. They decline to tell the line of manufacture in which they are to engage, but it is understood that it is electrical goods.

Irwin, Pa.—The Penn Electrical Manufacturing Company of Wilkinsburg has about decided to remove its plant to Irwin, the citizens of this place having agreed to donate a site and raise a cash bonus of $5,000. The plant manufactures all kinds of electrical appliances, globes and fixtures. F. C. Hockensmith and D. M. Wagner of Irwin are the principal stockholders in the company.

Mechanicville, N. Y.—A company has been organized to establish works here for the manufacture of all kinds of electrical supplies.

New York.—The "Journal of Commerce" of the 8th inst. says: "A member of a leading electrical engineering concern said yesterday that in railroad work the outlook for business was never better. The bulk of the orders are coming from the principal European cities. There are so many branches of trade interested in the development of electrical works that its promotion means considerable exports in the machinery line. There are said to be eight roads in England, two in Holland, four in Buenos Ayres, one in Cuba and two in Brazil figuring now on entire American equipments. They are to make the change from horse to electrical traction. The number of new roads contemplated are many and the inquiries in their behalf are from every part of the world."

Philadelphia.—A representative of the Philadelphia Commercial Museums, who has recently returned from Brazil, reports a marvelous increase in the demand for electrical goods in South America. He says that every town or city within 300 miles of the coast is lighted by electricity, and electric plants are being put in operation everywhere.

Ogdensburg, N. Y.—The prospects are considered good for the establishment in this city of a manufacturing plant to employ at least 150 men. A syndicate, at the head of which is Charles S. Westbrook, is to manufacture an improved electric light and power generator, and has obtained from the owners of the patent the right to make and sell the machines in sixteen counties of New York State. Instead of dynamos, a new device with storage batteries is used to generate the electric fluid.

Schenectady, N. Y.—The General Electric Company has received an order from the company which is constructing the underground street railroad in Paris for eight electric locomotives and the large quantity of apparatus that goes with them. The locomotives will be capable of pulling a train of five cars at a high rate of speed. The length of the road will be three miles.

Springfield, Ill.—The Crocker-Wheeler Electric Company has been licensed to do business in Illinois.

Victoria, B. C.—Mr. R. Cassidy at the coming session of the Legislature will apply for the incorporation of companies to build a railway from Taku inlet to Atlin lake; to operate electric lighting plants in Cassiar; to build a railway from Fort Simpson to Glenora, and to build cable, telegraph and telephone lines from Victoria to Teslin lake.

Washington, D. C.—Captain R. B. Bradford, Chief of the Bureau of Equipment of the Navy Department, in his annual report regards with much concern the constantly increasing demand for repairs and renewals for electrical outfits and supplies of ships. He says that as a monopoly practically controls the most important electrical supplies, with the usual high prices, he considers it advisable to erect at the New York Navy Yard sufficient appliances for the manufacture of the articles now purchased.

Watertown, Mass.—The recent adoption of electricity in operating the large electric crane in the Government Arsenal here is proving a great improvement on the old method. The crane has a lifting capacity of 45,000 lbs., is worked by one man and transports its load the whole length of the building, 288 feet, in one minute. Half a dozen hands were necessary to propel the crane from point to point by the old system and nearly an hour has often been consumed in moving it the length of the building.

POWER AND TRANSMISSION PLANTS.

Richmond, Va.—A charter has been granted to a construction company formed for the purpose of erecting a plant in this city to be used for the development of the water power of James river. The power so developed will be used in the generation of electricity to supply light and power for private and for manufacturing purposes. The capital stock of this company is to be not less than $5,000 nor more than $100,000, to be divided into shares of $100 each. The officers for the first year are as follows: President, R. Lancaster Williams of Richmond; vice-president, F. C. Todd of Baltimore; secretary and treasurer, A. W. Weddell of Richmond.

COMPANY MATTERS.

Bath, Me.—The report of the committee which has been investigating the affairs of the Bath Gas & Electric Company has been published and shows that the company was in rather bad financial condition. The plant is likely to pass into new hands now that its condition has been at last straightened out, and it is said that several Bath capitalists are talking of purchasing when the proper time arrives.

Lancaster, Pa.—William Given, receiver for the Pennsylvania Traction Company, announces that steps have been taken for a complete reorganization of the company at an early day. The United States Circuit Court recently granted a decree for a final adjustment of all accounts and the filing of liens against the road and the amounts due thereon of the respective lines, from which they shall be paid. This report will be submitted to the master, George L. Crawford of Philadelphia, who will order a sale of the road. The following committee on reorganization has been appointed: W. B Given, chairman; Samuel R. Shipley of Philadelphia, J. W. Bausman and John D. Skiles of Lancaster. The new company will be known as the Conestoga Traction Company. Receiver Given also announces that the receipts for the fiscal year ending November 30 were $200,170.62, an increase of $15,005.31 over 1897.

Rockford, Ill.—The stockholders of the Rockford Railway, Light & Power Company have voted to increase the capital stock from $250,000 to $350,000.

PERSONAL AND MISCELLANEA.

Mrs. Iva E. Tutt is the manager of an electric plant at Long Beach, Cal., about twenty miles from Los Angeles, and she has written for the Louisville "Courier-Journal" a brief account of herself as promoter and manager of a successful business. In her sketch she says: "Long Beach is one of the most beautiful sea coast towns of Southern California. Within a short distance lies Terminal Island, a fashionable resort, and further away San Pedro, the future seaport of Los Angeles and the surrounding country, where the Government is spending three millions of dollars to improve the harbor. These three towns are joined by an electric circuit and successfully lighted from the one central station. I came to South California in the spring of 1895, and located at Long Beach. I foresaw the future of this favored locality and decided to invest my means in and devote my energy to an electric plant. At that time these towns were lighted by oil I applied for franchises, bought the machinery and necessary grounds, directed all the details of the construction from the setting of the boilers to the construction of the pole lines. Eventually I found myself at the head of a model plant with miles of wires and an ever-increasing patronage. At times I have had to operate the station when the needs of the work called the men elsewhere. The plant is a modern one in every respect. The present equipment consists of a Sterling water-tube boiler fitted for mechanical draft, a tandem-compound engine and dynamos for direct and alternating currents. The direct current distribution is by the three-wire system. I am a native of Minnesota, a Daughter of the Revolution, and, if it interests any one to know, trace my ancestry to the colonial days."

The electric tramway at Cripple Creek, Col., running to Victor, is a little over six miles long, and consists almost entirely of grades and curves. The round trip occupies about one hour and twenty-nine minutes, which it is expected will be shortened to one hour. The electricity is generated by water power at Lake Moraine, at an altitude of about 10,000 feet on Pike's Peak, and transmitted by wire nearly a dozen miles to a distributing station midway on the line of the railroad. The entire route of the road is one succession of gold mines, while all the mountain slopes in view are dotted with the dumps and in many cases the shaft houses of mines in various stages of development. At Midway (the station for Altman, "the highest incorporated town on earth"), the line is 10,514 feet above sea level, and affords a magnificent panorama. The six incorporated towns of the Cripple Creek district have for some time past been lighted by electricity. A miner can already in many places in the district ride to his work in an electric street car, descend the mine in a hoist operated by electricity, and follow his work underground by an electric light.

INCORPORATIONS.

The Allentown & Slatington Street Railway Company Allentown, Pa.—to build and operate an electric railway. Capital stock, $200,000. Directors: Francis J. Crilly, Allentown, president; John L. Schwartz, Patrick F. Cannon, Walter J. J. Saeger, Allentown; Francis A. Kreitz, Slatington.

The South African General Electric Company of Schenectady, N. Y.—to deal in electrical apparatus, machines, engines and mechanical devices, and to construct works and plants involving their use in the United States, South Africa and other foreign countries. Directors: S. D.

Greene, Henry W. Darling, D. Mazent, J. B. Lovejoy and M. F. Westover of Schenectady.

The Groton Electric Company, Groton, Conn. Capital stock, $2,000.

The Victor Electric Company, Chicago, has certified to an increase of capital stock from $2,400 to $5,000.

The Natchez Light, Power & Transit Company, Natchez, Miss. Capital stock, $200,000. Incorporators: Maurice Moses and Abram Moses.

The Clarendon Light & Heat Company, Clarendon, Ark. Capital stock, $6,000. President, J. W. B. Robinson; vice-president, H. H. Bateman; secretary and treasurer, J. T. Jones.

The Greenup Light Company, Greenup, Ky.—to erect and maintain an electric light plant in the town of Greenup. Capital stock, $5,000. Incorporators: Charles Schmutz, J. E. Pollock and R. E. L. Wilson.

The Electric Haulage & Manufacturing Company, Brazil, Ind.—to manufacture motors and machinery. Capital stock, $10,000. Directors: James H. McClelland, Brazil; Edmund C. Morgan, Charles B. Niblack, Chicago, Ill.

The Williamsport Water & Light Company, Williamsport, Ind.—to operate a water system and furnish electric light. Capital stock, $10,000. Directors: John H. Brown, B. O. Mayer and George Mayer.

The Russell-Tomlinson Electric Company, Shelton, Conn.—to manufacture, buy, sell and deal in electrical goods and wares. Authorized capital, $20,000; paid in, $17,000. Incorporators: G. G. Milne, C. B. Barker, New York City; W. W. Tomlinson, Shelton; W. E. Russell, Danbury.

The Delaware County Electric Light & Power Company, Clifton Heights, Pa.—to supply light, heat and power by electricity. Authorized capital, $5,000. Incorporators: C. M. Wagner, E. O. Kane, Lansdowne; R. S. Austin, Philadelphia; S. Haigh, Aldan; J. S. Austin, Yeadon.

The Wardner-Kellogg Electric Railway Company, Wardner, Wash.—to build an electric railway from Kellogg, through Wardner, to the Bunker Hill mine, and from Kellogg to Government gulch. Capital stock, $500,000. Directors: Bartlett Pressley and Margaret Pressley of Kellogg, Lawrence O'Neill of Wardner and William W. Woods of Wallace, Wash.

ELECTRICAL PATENT RECORD.

Letters Patent Issued December 6, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

615,420. Electrical Connection. William E. Baker, Chicago, Ill., assignor to Carter H. Fitz Hugh, same place. Filed July 13, 1896.
615,592. Electric Locomotive. Martin E Thomas, Cassaday, Ky., assignor of three-fourths to W. F. Toops and H. L. Hendrick, Bowling Green, Ky. Filed July 12, 1897.
615,594. Electric Locomotive and Truck. Samuel M. Vauclain, Philadelphia, Pa. Filed Dec. 29, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

615,407. Electric-Arc Lamp. Moses S. Okun, New York City. Filed June 3, 1895.
615,408. Electric-Arc Lamp. Moses S. Okun, New York City. Filed Oct. 21, 1895. Renewed May 28, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

615,255. Alternating-Current Dynamo-Electric Machine. Sebastian Z. de Ferranti, Hollinwood, England. Filed Dec. 28, 1897.
615,351. Dynamo-Electric Machine. John E. Fuller, New York City, assignor to Caleb Coles Dusenbury, Lake Mahopac, N. Y. Filed March 24, 1898.
615,388. Apparatus for Operating Electric Switches. Charles Hartdegen, Newark, N. J. Filed July 30, 1897.
615,395. Circuit-Breaker. Frederick A. La Roche, New York City. Filed Dec. 28, 1897.
615,418. Automatic Rheostat. Eleazer T. Wilkinson, Philadelphia, Pa. Filed May 8, 1897.
615,419. Rheostat. Charles Wirt, Philadelphia, Pa. Filed July 23, 1897.
615,491. Automatic Weighing-Machine. Francis H. Richards, Hartford, Conn. Filed Nov. 26, 1897.
615,652. High-Frequency Apparatus. Thomas B. Kinraide, Boston, Mass. Filed May 13, 1897.
615,653. High-Frequency Induction Apparatus. Thomas B. Kinraide, Boston, Mass. Filed March 4, 1898.

TELEPHONE AND TELEGRAPH APPARATUS.

615,344. Telephone. Franz Burger and Henry M. Williams, Fort Wayne, Ind.; said Burger assignor of one-half to said Williams. Filed Aug. 16, 1897.
615,349. Electric Cable Conductor. Stephen D. Field, Stockbridge, Mass., assignor to the American Bell Telephone Company, Boston, Mass. Filed Dec. 24, 1897.

BATTERIES.

615,246. Electric Battery. Owen T. Bugg, Jr., New York City. Filed March 15, 1898.
615,292. Electric Battery. Maurice Maas, New York City. Filed Sept. 7, 1897.
615,539, 615,540, 615,541. Electric Battery. Philip A. Emanuel, Aiken, S. C. Filed May 17, 1898.

MISCELLANEOUS.

615,317. Electric Switch. William Ely, Providence, R. I. Filed Aug. 11, 1895.
615,385. Electrical Appliance for Elevators. James H. Roberts, Grand Rapids, Mich. Filed Dec. 27, 1895.
615,581. Block-Signal System. William L. Stockton, Trenton, Ohio. Filed Dec. 20, 1897.

DESIGN.

29,782. Insulator. Jacque L. Morgan, Kansas City, Mo. Filed Sept. 6, 1898.

TELEPHONE AND TELEGRAPH.

Snow and Telephone Wires.

A Swiss electrical engineer calls attention to the importance of devising some means for the prevention of heavy accumulations of snow on telephone lines. It frequently happens that these wires are placed in the neighborhood of electric currents of the high tension used in the majority of towns, and breaking of the telephone wire may in an instant lead to the diversion of heavy currents and the possibility of loss of life. In ordinary weather the weight of snow lodged on the wires is inconsiderable, but during heavy falls of snow this accumulation may become serious. It was estimated that on the lines in the neighborhood of the meteorological station at Zurich, during a storm in April last, there was a weight of 60 kilograms of snow on a stretch of 100 meters, or more than forty times the weight of the wire itself. Between the two posts supporting the 250 wires traversing the Lurimat, at a distance of about 100 meters apart, the additional weight from the snow was about 15,000 kilograms. This is not the only source of danger in winter. The tension resulting from a sudden fall in temperature to the neighborhood of zero greatly increases the chance of sudden breakages from whatever reason. The question of adopting some means of lessening the danger from the snapping of telephone wires is being actively taken up in Europe.

There has been erected in the city of Brussels, Belgium, a spacious building to be devoted exclusively to the telephone service of the country, and it is now expected it will be open to the public some time during the coming year. The building is situated in the old quarter of the city, the selection of the location being no doubt influenced by economical reasons, as the land was Government property. The construction of the building has cost very nearly $193,000, and there will be commutators for 15,000 subscribers. The building comprises a basement, ground floor, and three stories. The room devoted to the commutators has a length of 147 feet, a width of 65 feet, and a height of 30 feet. Below the massive concrete foundation, a series of iron rafters has been laid to facilitate the flowing of electricity into the ground. Steel shanks are attached to these rafters and connected with the iron pieces of the building in all directions in such manner that the entire construction is united in a Faraday cage, which thoroughly protects it against lightning. On account of the large number of overhead traction cables already existing in Brussels, and the impossibility of a much further increase in the number or dimensions of telephone support frames, it has been decided to put nearly all the wires of the telephone service underground, and in consequence cables containing two hundred wires will be placed in underground conduits to be distributed in the various quarters of the city.

Elias E. Ries, one of the charter members of the United States Automatic Telephone Company, recently incorporated at Albany, N. Y., with a stated capital of $1,000,000, is the inventor of the new system which the company was organized to control. By his invention, he says, connection between the telephone subscriber and the central office is effected automatically through the flow of a small quantity of mercury, which is placed in the receiver, the tilting of the receiver as it is lifted to the ear causing the mercury to make the connection. Mr. Ries claims that in his system the cost of insulation is less than half that of the Bell system. From the central exchange they could give 65 to 70 per cent. more service, and consequently operate profitably at much lower rates than the Bell company.

At Springfield, O., the Central Union Telephone Company, after a hard fight against four other companies, has been granted the right to construct an underground conduit system in the central part of the city, the construction to be commenced within 90 days from passage of the ordinance. The action was taken by the Board of Public Affairs after a heated presentation of claims by representatives of the different companies seeking the franchise. The action of the board excludes all others so long as the Central Union will give a first-class service at reasonable rental. The rates will be reduced and the city will receive five new telephones free, besides the number granted under the old franchise.

The Standard Telephone Company is about to extend its line into La Crosse, Wis. For some time the work has been in progress and now the line extends through southern Minnesota and has reached a point on the Minnesota side of the river opposite La Crosse. A cable will be laid in a few days connecting the line with that of the La Crosse Telephone Company. Arrangements have been made whereby the Rushford Telephone Company will use the cable of the Standard Company. This extension will give La Crosse connection with all points in southern Minnesota.

A conference between the officers of the Iowa and Nebraska divisions of the Bell Telephone Company and two independent toll lines operating in Iowa, Minnesota and North Dakota was held last week in Des Moines, Ia. The conference was held relative to traffic arrangements between the three companies—for the consideration of the arrangement of joint use of wires and joint rates. The conference is the first of the kind ever entered into in Iowa by the Bell Telephone Company. It is important in that it is evidence of a new policy on the part of that system's management to work with the independent and Mutual toll lines.

At a public hearing at Boston on the 8th inst. on the petition of the Massachusetts Telephone & Telegraph Company for locations in the streets of Boston, a paper was presented signed by Oakes Ames, Albert O. Titcomb, E. P. Shaw, John Shepard, George A. Alden, D. L. Demmon, Francis W. Breed, W. H. Brewster and Benjamin Deckerman, who in case a franchise is granted agree to join in the organization of the new company, which will have a capital of between $2,000,000 and $3,000,000. It is proposed to cut present rates in halves.

The East Tennessee Telephone Company (Bell) is said to have made arrangements for putting in a plant at Richmond, Ky., and proposes to compete with the Richmond Telephone Company, which was one of the first local companies organized in the State. The rates of the local company are $2 per month for offices and $1.50 for residences, which rates the newcomers propose to smash, putting in their instruments in offices for $1.50 and in residences for $1.

There is a fight on at San Jose, Cal., between the People's Telephone Company and the Sunset Telephone Company, in which the latter is backed by the city officials. The citizens and business men especially, recollecting the high rates that prevailed before the People's Company's advent, are however disposed to stand by the latter.

In order to bring the military telegraph and telephone service in Cuba up to as high a standard as possible, Lieut. Col. H. H. C. Dunwoody of the Signal Corps has been directed to proceed to Havana and take charge of the entire system. The work of construction and repair will be accomplished by parties of enlisted men in the Signal Corps.

The contract of the New York & New Jersey Telephone Company to put telephones in thirty-seven schools and the homes of the three school superintendents for $31,000 has been approved by the borough board of the Borough of Queens.

The Bell Company having gobbled up several independent companies in Minnesota is now turning its attention to Iowa, where it has succeeded in taking in two small companies, which together operate about 200 miles of line.

The exchange of the Cumberland Telephone and Telegraph Company at Memphis, Tenn., was damaged by fire on the 8th inst. to the extent of $7,000. The battery room was totally destroyed.

New Companies Incorporated.

The Pacific Automatic Telephone Company, Seattle, Wash. Capital stock, $100,000.

The Danville Telephone Company of Danville, Ill., has certified to an increase of capital stock from $25,000 to $50,000.

The Automatic Telephone Company, New Bedford. Capital stock, $100,000. Incorporators: J. W. Macomber and Frederick Tabor.

The Northern Illinois Telephone Company, Hinckley, Ill. Capital stock $10,000 Incorporators: Fred E. Graves, Milton D. Patten and Fred R Patten.

The Hinton & Southeastern Telephone Company, Hinton, W. Va. Capital stock, $50,000; paid in, $10. Incorporators: A. J. Skaggs, James H. Miller, J. J. Swope, C. H. Skaggs and W. H. Bonde.

The United States Automatic Telephone Company, New York City—to manufacture and deal in telephonic and electrical apparatus. Capital stock, $1,000,000. Directors: Elias E. Ries, Martin Lowenstein, Henry A. J. Wilkens, Israel Steinhart and Henry J. Furlong, of New York City.

The Printing Telegraph & Typewriter Company, St. Paul, Minn.—to acquire, own and lease telegraph and typewriter instruments, etc. Authorized capital, $200,000. Incorporators: Casper Ernst, St. Paul; Frederick Hachman, Milwaukee; Charles Pfeifer, Plymouth, Wis.

The Homestead Telephone Company, Homestead, Pa.—to construct and maintain telephone lines. Authorized capital, $10,000. Incorporators: Dr. G. Gladden, R. Kennedy, J. Purman, D. H. Carus, A. J. Kuhn, W. S. McConegby, H. J O'Donnell, Homestead. Reid B. Kennedy has been elected president of the company, A. J. Kuhn treasurer and Dr. John Purnam secretary.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Dec 12:						
Albany Ry. Co	100	2,000,000	$1,750,000	1¼ % Q., Aug. '98.	150¼	151
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug., 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	..	..
Allentown Pa.—Dec 12:						
Allentown & Lehigh Val. Trac. Co	....	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Dec 12						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Dec 12:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98.	...	...
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	81¼	81⅛
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	...	..
Boston, Mass.—Dec 12:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	18¼	18¾
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	10	12
North Shore Traction Co........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	73	77
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	89¾	91
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	110	110¼
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	81	84½
Brooklyn N. Y.—Dec 12:						
Brooklyn City & Newtown Ry	100	2,000,000	1,928,400	2 % Feb. 1, 1898.	250	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	72⅞	58
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR........guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	283	283¼
eBrooklyn, Queens Co. & Sub. RR	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	..	275
Kings County Elevated	....	4,750,000	4,750,000	....	8½	5
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	48	..
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	70	72
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Dec 12						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	60	66
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	77	78¼
Columbus O.—Dec 12:						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Aug., '98.	59	60
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Dec 12:						
Charleston City Ry. Co	50	100,000	100,000	8 % S., Jan., '98.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Dec 12:						
Chicago City Ry. Co	100	12,000,000	12,000,000	8 % Q.	298	..
Chicago & South Side R. T. RR	100	10,828,800	10,828,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	14	14¼
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	4
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	8 % Q., Oct., 98.	26	227½
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,608,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Nov. 98	97½	98
jChicago West Div. Ry.......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Dec 12:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	..
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	...	80¼
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118¾	119¼
Mt. Adams & Eden Park Inc. Ry	50	2,500,000	2,200,000	1½ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Dec 12:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	40	42
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	61	68
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98	79	80
Detroit, Mich.—Dec 12:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Dec 12:						
City Railway Co............com.	100	1,500,000	1,470,600	1½ % Q., Jan.1,'98.	108½	109
City Railway Co..............pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	157
People's Street Railway	....	1,100,000	....	....	105	..

*Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Dec 12:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	—
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	—
Holyoke Mass.—Dec 12:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	185	200
Hoboken, N. J.—Dec 12:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	105	—
Indianapolis, Ind—Dec 12.						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	26½	28
Lancaster, Pa.—Dec 12:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	—
Lancaster & Col. Electric Ry	....	....	87,500	....	..	—
West End Street Railway	...	....	....	....	..	—
Louisville, Ky.—Dec 12:						
Louisville Ry..........com.	100	4,000,000	8,500,000	1¼ %., Oct., '97.	35	40
Louisville Ry..........pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	101	108
Minneapolis, Minn.—Dec 12:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	28	31
Twin City Rapid Transit....7 % pfd.	...	8,000,000	1,714,200	1¾ %, Jan., '98.	101	108
Montreal, Canada.—Dec 12:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	278	279
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	105¼	105¾
Memphis, Tenn.—Dec 12:						
Memphis Street Railway Co	100	500,000	500,000	....	15	—
New Haven, Conn.—Dec 12:						
Fair Haven & Westville RR	25	1,500,000	900,000	8 % S., Sept. '98.	80	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000	....	..	—
Winchester Avenue RR	25	1,000,000	600,000	....	45	..
New Orleans, La.—Dec 12:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	152	200
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	122	127
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	2	2½
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	8	11
aCrescent City RR..........guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	18	21
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	..	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	25	27
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	54	58
New York—Dec 12:						
Central Crosstown RR	100	600,000	600,000	2½ % Q.	255	..
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	160	165
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98.	165	165
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98	193	193½
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	85½	87
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	225	230
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	167	165
hEighth Avenue RR	100	1,000,000	1,000,000	....	348	400
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	..
jNinth Avenue RR.........guar.	100	800,000	800,000	....	165	180
kSixth Avenue RR..........guar	100	2,000,000	2,000,000	....	200	210
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	390	410
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	180	185
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. 18.	165	166½
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	74½	75
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Dec 12:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	56½	57
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Dec 12:						
Allegheny Traction Co	50	500,000	500,000	....	..	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	21⅞	22⅛
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %, May, '97.	55¼	55½
pCentral Traction Co	50	1,500,000	‖900,000	1½ % Nov. 7, '98.	..	...
qCitizens' Traction Co	50	8,000,000	‡8,000,000	6 % A.	..	...
rDuquesne Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3½ %, Nov. 7, '98.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	26	26¼
Pgh., Allegheny & Man. Trac. Co	50	8,000,000	‖2,994,880	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry	25	8,000,000	8,000,000	½ %, Jan., '96.	..	21¼
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October.

s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass.—Dec 12						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass.—Dec 12						
Northampton Street Ry	100	300,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Dec 12						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Dec 12:						
Paterson Ry. Co.	100	1,250,000	1,250,000		54	..
Providence, R. I.—Dec 12:						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	70	72
Philadelphia.—Dec 12:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‡1,966,100	2½ %, July 15, '98.	42	..
Hest'nvi'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98.	63	..
aFairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3 % Feb. 1, '98.	66	..
Union Traction Co......... $12½ pd	50	30,000,000	29,980,450	....	30⅞	31
bElectric Traction Co.	50	....	8,297,920	....	...	..
dCitizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	330	..
eFrankford & Southwark Pas. R	50	....	‡1,875,000	$14 sha'e A—Apr.98	405	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	48	..
fLombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	275	...
cPeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‡572,800	$5.25 share—1898.	185	188¼
gGreen & Coates Passenger Ry.	50	500,000	‡150,000	3 % Jan., 1898.	135½	..
hPeople's Passenger Ry....com.	25	1,500,000	‡740,000	....	...	...
hPeople's Passenger Ry.... pfd.		750,000	‡277,402	....	...	...
iPhiladelphia Traction Co.	50	30,000,000	‡20,000,000	$2 p sh., Oct. 98.	91	94¼
jCatherine & Bainbridge St	50	....	‡400,000	6 % A—Mar., '98.	...	...
jContinental Pass. Ry.....guar.	50	1,000,000	‡580,000	$6 share—July, '98.	140	145
jEmpire Passenger Ry. Co	50	600,000	‡600,000		...	...
jPhiladelphia City Pass. Ry	50	1,000,000	‡475,000	$7.50 share July '98	170	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90	..
jRidge Avenue Passenger Ry	50	750,000	‡420,000	$12 share, July '98.	295	300
jPhiladelphia & Darby Ry.guar.	50	....	‡200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar.	50	....	‡250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‡335,000	$11 sh. A., July, '98	250	..
jUnion Passenger Ry. Co	50	1,500,000	‡900,000	$9.50 shre, July '98	228	..
jWest Philadelphia Pass. Ry	50	750,000	‡750,000	$10 share, July '98	235	250
Rochester, N. Y.—Dec 12:						
Rochester Railway Co	100	5,000,000	5,000,000	....	14	15
Reading, Pa.—Dec 12.						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
kCity Passenger Ry	50	350,000	350,000	Jan., '98.	114	..
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98	65	..
St. Louis Mo.—Dec 12.						
Fourth Street & Arsenal Ry	50	300,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1½ % Oct, '98.	167	169
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	120	125
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000		..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '93.	..	..
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	100	2,400,000	2,300,000	1½ % Oct, '98.	190	193
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry.......com.	50	1,000,000	500,000		62	64
Southern Electric Ry.......6 % pref.	100	1,000,000	1,000,000	3 %. July, '98	130	131
St. Louis & Suburban Ry	100	2,500,000	2,500,000		58	59½
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	125	130
San Francisco, Cal.—Dec.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly	109	..
Geary Street Park & Ocean RR	100	1,000,000	375,000	$2.50 share, '96	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share	55½	56
Presidio & Ferries RR	100	1,000,000	550,000	....	8½	..
Scranton, Pa—Dec 12						
Scranton Railway Co	50	6,000,000	2,500,000	....	12½	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Dec 12						
Springfield Consolidated Ry	100	750,000	750,000	....	...	..
Springfield O.—Dec 12:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	..
Springfield, Mass.—Dec 12:						
Springfield Street Ry	100	1,200,000	1,166,700	4 % A	200	2 7½
Toronto Canada.—Dec 12:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	105¼	10 ¾
Montreal Street Railway Co	....	4,000,000	4,000,000	4 % S	2 8	2.9
Washington, D. C.—Dec 12						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	12,000,000	12,000,000	65c. per sh, Oct. 97.	87⅛	87½
Columbia Ry. Co	50	400,000	400,000	6 % A.	65	75
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	17½	..
Georgetown & Tenallytown Ry	50	200,000	200,000		..	..
Metropolitan RR. Co	50	1,000,000	458 900	2½ % Q.	128	131
Worcester, Mass.—Dec 12:						
*Worcester Traction Co.........com.	100	3,000,000	3,000,000	....	12½	13
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	91	93
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897	85	..
Wilkesbarre, Pa.—Dec 12:						
Wilkesbarre & Wyoming Val. Trac	100	5,000,000	5,000,000	1%. Jan., 97	24	29

* Unlisted. † Paid in. ‡ Full paid. § Outstanding ‖ Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.

e Leased to Electric Traction Company.

f Controlled by Frankford & Southwark Passenger Railway

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a., in 189[illegible]-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Dec 12						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., Oct., '98.	..	279
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '98.	75½	76
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	133	..
New York.—Dec 12						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	97	98¼
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	108	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	175	...
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	75¼	76
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	110	..
*International Ocean Tel Co.guar 6 %	100	3,000,000	......	1½ % Q.	109	..
Mexican Telephone Co	10	2,000,000	......		..	20
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	1½ % Q., Oct., '98.	150	155
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar. 5 %	25	950,000	559,525	2½ % S.	90	93
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., July, '98.	110	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	95½	95¾
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Dec 12:						
American Dist. Teleg. (Phila.).	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	172½	...
Chesapeake & Potomac Teleph. Co	100	......	......	....	51	...
Chicago Telephone Co	100	......	......	....	210	...
Central Dist Prtg & Telg.Co.(Pgh.)	100	750,000	750,000	......	132½	134
Empire & Bay States Telegraph Co	..	......	......		75	80
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	77	...
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q	112	118
Providence (R. I.) Teleph. Co.	50	......	......	....	89½	...
Southern New Eng. Teleph. Co	100	8,000,000	......		121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Dec 12:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec Series A.	25	......	......	....	...	..
†General Electric Co. [old] com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new] .... "	100	18,276,000	18,276,000	......	98¾	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2¾	8¼
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	89	89¼
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	60	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Dec 12:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,988,000	....	..	188
*Edison Elec Ill'g Co., Brooklyn	100	4,000,000	2,000,000	1½ % Oct., '98.	..	..
Edison Ore Milling Co	100	....	......	....	11	14
Edison Electric Storage Co	..	......	......		28	30
†General Electric Co. [old] ....com	100	10,000,000	30,460,000	2 % Q., Aug, 1898.	..	...
General Electric Co [new] .... "	100	18,276,000	18 276,000	.....	93⅞	94
Interior Conduit & Insulation Co.	100	1,000,000	1,000,000		41	..
Pittsburg, Pa.—Dec 12:						
Allegheny County Light Co	100	500,000	500,000	J. & J	165	175
East End Electric Light Co	50	300,000	800,000	Q	..	10
Philadelphia, Pa.—Dec 12:						
Edison Electric Light Co	100	2,000,000	.....		144⅛	..
*Electric Storage Battery Co..com.	100	8,500,000	..	....	53¾	54
*Electric Storage Battery Co.. pfd.	100	5,000,000			63¾	64¼
‡ Kings Co. El. L. & P. Co	100	2,500,000	2,500,000	A. & O.	..	153
*Penna. Ht., Lt. & Pow. Co ..com.	50	5,000,000	..	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co	10	550,000	550,000	$32500 dis. Jan.11'97	13¾	14
Southern Elec. Light & Power Co	10	187,500	187,500	....	18¼	..
Miscellaneous.—Dec 12:						
Brush Electric Co	50	..	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	41	45
Missouri-Edison (St. Louis)....com.	..	......	......	....	11	13
Eddy Electric Mfg. Co	25	......	......	....	...	15
Hartford (Conn.) Elec. Light Co	100	350,000	......	....	125	..
Hartford (Conn.) Lt. & Power Co	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	177	..
Narragansett (Prov., R.I.) Elec. Co	50	1,200,000	......	2 % Q., Oct., '98.	84	..
Rhode Island Elec. Protec. Co	100	......	......	...	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	......	2% Q	157½	158½
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	138⅞	139⅞
Thomson-Houston Welding Co	100	...	...	3 % S, Dec. 1, '96.		100
Woonsocket (R. I.) Electric Co	100	..	...	....	100	..

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,100 of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Dec 12:						
American Electric Heating Co	50	10,000,000	......		..	..
Street Ry. & Illu'g Properties...pfd	100	1,500,000	1,218,700	$2 p sh. Nov. 16, '98	..	85
United Electric Securities Co...pfd.	100	..	1,000,000	3½ % May 2, '98.	92	100
New York.—Dec 12:						
Consolidated Electric Storage Co	..	.			9½	16
Edison European	..	..	......	..	..	...
Safety Car Heating & Lighting Co	100	..	......	...	105	...
Worthington Pump Co........com.	100	5,500,000	5,500,000	.	84	40
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	99	101
Philadelphia, Pa.—Dec 12:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	.	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	.	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	..	....	..	..
Welsbach Commercial Co ....com.	100	3,500,000	..	....	10	10½
Welsbach Commercial Co......pfd.	100	500,000	.....	2 % Q	62	63
Welsbach Light Co	5	525,100	...	.	33	33⅝
Welsbach Light Co., Canada	5	500,000	...		..	2¼
Pittsburg, Pa.—Dec 12						
Carborundum Mfg. Co	100	200,000	200,000		..	..
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	117	..
Miscellaneous.—Dec 12:						
*Barney & Smith Car Co.......com.	100	..	1,000,000	....	18	16
*Barney & Smith Car Co ....pfd.	100	....	2,500,000	2 %	60	...
Billings & Spencer Co	25	......	.... ..	...	80	86
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	85	88
Johns-Pratt Co	100	......	....	....	90	100
*Pratt & Whitney Co..........com.	100	......	....	....	1½	8
*Pratt & Whitney Co............pfd	100	......	....	....	..	47
Stillwell-Bierce Co.............com.	..	......	....	....	..	...
Stillwell-Bierce Co..............pfd.	..	.....	......	2 % Sept. 1, '98.	95	98
Shults Belting Co	100	500,000	......		82	87
St. Charles Car Co	.	------	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Dec 12, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry.................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*115½	....
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*114	115
‖Watervleit Turnpike & RR.1st mtg. 6s	850,000	850,000	1919	M. & N.	*120	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*116	....
Troy City Railway Co.....................1st 5s	....	....	......	......	*106½	......

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Dec 12, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113	114
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	116	116⅛
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103	104
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	117	1 8
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	......	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co............1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	115	116
City & Suburban Ry......1st mtg. g 5s.	3,000,000	3,000,000	1922	J. & D.	116	.....
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113½
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	120¾	......

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Dec 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.........1st mtg. g. 5s.	5,379,000	8,702,000	1924	J. & D.	104	105
West End Street Ry.........Deben. g. 5s.	8,000,000	8,000,000	1902	M.& N.	105	105¼
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation Dec 12, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.. ......1st mtg. 5s.	500,000	47,000	1906	J. & J.		
†Charleston City Ry ....1st mtg. 6s.	850,000	....	....	J. & J.		

†Controlled by Charleston St. Ry. Co.

Chicago Ill

Date of Quotation—Dec 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¾	103
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R T...1st mtg. g. 5s	7,500,000	7,500,000	1929	A. & O.	.....	...
Chicago & So. Side R. T............ .4½s	1,500,000	750,000	1907	J. & J.	.....	.....
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	105½	......
Lake Street Elevated RR..1st mtg. g. 5s	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	61½	......
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¾	.....
North Chicago St. RR.....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	...	......
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	101½	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	106½	107
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	103½	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	......
West Chicago St. RR.....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	96	96¼
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Dec 12, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	106	106¼
†Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103½	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	112¾
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	108	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119¼	......
‖So. Cov. & Cin. St. Ry ......2d mtg. 6s.	400,000	400,000	1932	J. & J.	131	134

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Dec 12 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	105½	106
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	106	106¼
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	104	104½
†Cleveland Electric Ry.Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103	105
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
aEast Cleveland RR. ....1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	107	108
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	...	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	.....	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Dec 12 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	8,835,000	1905	A. & O.	98½	100
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	877,000	1902	A. & O.	....	....
The Detroit Ry.................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	100	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Dec 12, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	108	......
New Haven (Edgewood Div.) 1st mtg. 5s	250,000	250,000	1914	J. & D.	107	....
Winchester Avenue RR.....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. [illegible]	100,000	94,00[illegible]	1908	M. & S.	102	......

*With interest. *Unlisted.

New Orleans La.

Date of Quotation—Dec 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR..........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	103	......
Crescent City RR.............1st mtg. 6s.	....	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83⅞	84½
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	104½
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	107¼	108¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	111	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	89	.
‡St. Charles St. RR. Co......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	103	......

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Dec 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn).....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn).1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	110	111
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	120	123
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	116	119
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	103	105
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	114	116
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	115
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	93
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	110	112
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	101½	105
Brooklyn Rapid Transit..........gold 5s.	7,000,000	5,181,000	1945	....	109	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	103	104
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111	113
Central Crosstown RR.........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	120
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	108
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115¾	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	103½
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115½	117½
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	97½	99
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	123¾	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1[illegible],500,000	1997	F. & A.	118	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	117	118
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.	....	....
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	113½	115
South Ferry RR. Co......... 1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR ....1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	128	......
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	......	....
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	113	114
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112½

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Dec 12 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry.....................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry.............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Dec 12 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry.......................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry....................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry.....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1948	......	105½	105¾
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co.........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry.........1st mtg. 7s	100,000	100,000	1908	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co.................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry..........1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry..........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry.............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Dec 12 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	......	......
Central Traction Co................1st mtg. 5s.	375,000	375,000	1930	J. & J	109½	....
Citizens' Traction Co..............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	112¼	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	......	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	107½	108
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	......	......
Second Ave. Traction Co.....................5s.	2,500,000	2,000,000	1934	J. & D.	111	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Dec 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.	......	...
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,760,000	1933	M. & S.	108½	110

St. Louis.

Date of Quotation—Dec 12, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	108
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co.............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter.—1st 6s	[illegible]	[illegible]	[illegible]	J. & J.	1[illegible]8	1[illegible]5

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis.						
Date of Quotation—Dec 12, 1898						
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	108
Lindell Ry. Co.........................1st mtg. 5s	1,500,000	1,500.000	1911	F. & A.	10·½	109½
Missouri RR. Co....	1,000.000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co..............1st mtg. 6s.	400,000	800,000	1910	A. & O.	101	108
People's RR. Co.....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co........................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	10⅝	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	105	107
St. Louis & Sub. Ry................Income 5s.	800,000	800,000	......	....	65	70
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	118	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	118½	115
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	108½
Union Depot RR. Co.........Cons. mtg. 6s.	8,500,000	1,787,000	1918	J. & J.	114½	115½
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
¶Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bds.						
San Francisco Cal.						
Date of Quotation—Dec, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	115½	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	114½	......
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	.....	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	8,000,000	8,000,000	1918	J. & J.	128½	129
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126	......
†Park & Cliff House RR........1st mtg. 6s.	850,000	850,000	1912	J. & J.	106½	108½
†Park & Ocean RR.................1st mtg. 6s.	250,000	250 000	1914	J. & J.	112	......
†Powell St. Ry........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	123
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C.						
Date of Quotation—Dec 12, 1898.						
Belt Ry. Co..........................Cons. mtg 5s.	500,000	450,000	1920	J. & J.	51	....
Columbia Ry...............................mtg. 6s.	500,000	500,000	1914	A. & O.	118	125
Eckington & Soldiers' Home. mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	128	......
†$50,000 in escrow to retire 1st mtg. bds.						
Miscellaneous.						
Date of Quotation—Dec 12, 1898.						
Bridgeport Traction Co.........1st mtg. 5s.	2,000,000	1.688,000	1928	J. & J.	102½	......
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	8,543,000	1931	F. & A.	112½	114
†Citizens' St. R. (Ind'polis). 1st cons. m. 5s	4,000,000	8,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg. 5s.	8,000,000	2,366,000	1932	M. & N.	110¾	111
¶Columbus (O.) St. Ry.......1st cons. g. 5s.	8,000,000	2,261,000	1932	J. & J.	108	105
Consolidated Traction (N. J.)..1st mtg. 5s	15,000,000	13,965,000	1933	J. & D.	107¼	10 ¾
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg. g. 5s	2,000,000	572,000	1933	J. & D.	102	102⅜
Denver City Cable Ry.........1st mtg. g. 6s.	4,000,000	8,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g. 5s.	6,000,000	4,931,000	1930	J. & J.	116	117
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	1,050,000	1919	J. & J.	100½	101½
††No. Hudson Co. Ry. (N.J.). Cons. mtg. 5s	8,000,000	2,378,000	1928	J. & J.	101	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.).......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry.......Cons. mtg g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry.............1st mtg. 5s.	8,000,000	2,000,000	1930	A. & O.	95	100
St. Paul City Ry......................Cons. g. 5s.	5,500,000	4,298,000	1937	......	.....	......
St. Paul City Ry.........................Deb. g. 6s.	1,000,000	1,000,000	1900	......	......	....
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass.						
Date of Quotation—Dec 12, 1898						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	109	110
Pittsburg, Pa						
Date of Quotation—Dec 12, 1898						
Allegheny County Light Co................6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Dec 12, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	111¼	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1998	......	121	....
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	110	115
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1928	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co (N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Dec 12, 1898.						
American Bell Telephone......................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co..................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen. mtg. 5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous.						
Date of Quotation—Dec 12, 1898.						
American Electric Heating...........5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co..................	....	....	......	......	......	25
Berney & Smith Car Co..................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co..................6s	....	....	1904	M. & N.	....	....
Worthington Pump Co	[illegible]	......	......	......	....	....
*Unlisted	Nominal					

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12.65@12.75c.; Lake, 12.75@13c.; casting, 12.65@12.75c.

Cleveland City Railway stock sold at 83 last week, the highest point in its history.

The Commercial Cable Company has declared a quarterly dividend of 1¾ per cent., payable January 3. Books close December 21 and reopen January 4.

The Boston Elevated Railway Company has declared a semi annual dividend of 2½ per cent., payable January 2. Books close December 19 and reopen January 3.

The United Traction & Electric Company, Jersey City, has declared a dividend of 1 per cent., payable January 3. Transfer books close December 21 and reopen January 4.

Chicago dispatches say that no kind of a franchise ordinance for the street railway companies of that city will pass the city council until the Allen law is repealed by the State Legislature.

The application of the Knoxville (Tenn.) Traction Company to the Baltimore Stock Exchange for the listing of $750,000 of stock and $850,000 of bonds has been favorably reported on by the committee on securities of the institution.

The Milwaukee Street Railway Company, through Vice-President Henry C. Payne, has withdrawn its proposition to pay $2,650,000 for immunity from hostile legislation for an exclusive franchise and the preservation of the five-cent fare for twenty-five years longer. This leaves the situation exactly the same as it was before.

A Columbus, O., dispatch states that arrangements are being made for the consolidation of the Edison Electric Light & Power Company, the Columbus Gas Company and the Columbus Electric Light & Power Company, of that city. It is stated that parties representing the companies have left for New York to complete the deal.

An answer has been filed at Pittsburg, Pa., to the suit charging fraud and conspiracy in connection with the reconstruction and re-equipment of the Pittsburg & Birmingham Traction road. The traction company was the plaintiff. The defendants, H. Sellers McKee, Murry A. Verner, David C. Brickell and others, deny all the allegations.

A dispatch from Hartford, Conn., states that the Meriden, Southington & Compounce Tramway Company has prepared a petition to the General Assembly for permission to increase its capital stock to $500,000, with rights to build and extend its tracks from Milldale to Mt. Carmel, to Waterbury, to Meriden and to Berlin, by an independent route, and to Plainville from its present Southington terminus, from Dunham's, on Queen street, to Compounce Lake, and to build a cable road to West Peak.

The directors of the Edison Electric Illuminating Company of Brooklyn have issued in pamphlet form a history of that corporation's organization and growth. The company was incorporated in 1887 with a capital of $500,000. At the time of its purchase by the Kings County Electric Light & Power Company its capital had been increased tenfold, to $5,000,000. The bonds with which the Edison Company stockholders were paid sell to-day at 121 or a valuation in addition to the mortgage on the Edison property of more than $6,000,000.

The press dispatch from Baltimore that the Westinghouse Air Brake Company had acquired control of the Brush Electric Light Company of that city is now stated to be entirely without foundation. The Westinghouse Electric Company, which owns a controlling interest in the shares, has recently purchased nearly all of the outstanding special mortgage bonds at 50 cents on the dollar, with a view to so reducing the fixed charges of the company that it will be enabled to pay dividends on its common stock and carry forward needed extensions.

The Baltimore & Northern Electric Railway Company of Baltimore, backed by a syndicate of New York, Philadelphia and Baltimore capitalists, has purchased the Baltimore City Passenger Railway, paying, it is alleged, $90 a share for the 14,000 shares, which were issued at a par value of $25. The stock has paid 10 per cent. for several years. The deal was consummated on the 9th inst. For several weeks the Consolidated Railway Company of Baltimore, the only competitor of the City Passenger Railway, had been negotiating for the purchase of the latter company, but their offer of $85 per share was outbid by the Baltimore & Northern.

Of the sale of the Lindell systems in St. Louis the "Globe-Democrat" of that city gives the following details: "It was decided that not less than $160 was to be taken for the Lindell stock, and not less than $182 for that of the Missouri Railroad Company. The purchase price paid is on the basis of $174 a share for the Lindell stock and $192 for the Missouri. These prices are higher than were ever paid for the stocks in the open market, and were secured only after Mr. Whitaker, Capt. H. C. Haarstick and C. D. McClure, who visited New York as a special committee, convinced the prospective purchasers of the splendid condition and undoubted value of the property of the two roads."

Holders of New Orleans Traction Company securities are notified to deposit them with the Continental Trust Company of New York under the committee's plan of reconstruction. Two dollars per share on the preferred stock and one dollar on the common stock is payable at the time of deposit. After January 10 the right to participate is forfeited. Under the reorganization plan bonds to the amount of $6,141,800 will be issued, $3,000,000 being first mortgage bonds, bearing 4 per cent. for five years and 5 per cent. thereafter. The plan provides for the union in one company of the New Orleans City & Lake Railroad, the Crescent City Railroad and the New Orleans Traction Company. This it is believed will give the company important advantages, both in enabling greater economy in the operation and more compact management and control generally, as well as by creating a better market for the securities of the reorganized company.

On Saturday last a statement attributed to John D. Crimmins appeared in the daily papers, announcing that William C. Whitney and his associates in the ownership of the Metropolitan Street Railway had succeeded in getting control of nearly all the electric lighting and subway interests in New York City, including the Edison Illuminating Company, the Mount Morris Electric Company and the Empire Subway Company. The statement was given with such detail that it was generally accepted as correct, and so it turns out to be, with the exception that the great Edison lighting company was not included in the deal. The motive of the enterprising financiers who are named in connection with this new acquisition is a subject of much conjecture; there is evidently more in it than appears on the surface, but for the present the public must be satisfied with the following explanation from Mr. Whitney which appears in the Sunday "Times." In reference to the published report Mr. Whitney says: "The affair has been greatly exaggerated. Of course I have for a long time been greatly interested in the affairs and working for the prosperity of the Metropolitan Traction Company. An attempt has been made to sell what power this company can furnish which is now not in use. With this end in view the Mount Morris Electric Company has been bought, as well as the control of two or three smaller companies. We have also purchased the subways. This much I will say, but more I cannot divulge at present. Heretofore I have declined to talk at all regarding this affair. I will add, however, that this enterprise will not include the furnishing of light. We cannot enter into that." It is now believed that the Whitney syndicate is the power behind the New York Gas & Electric Light, Heat & Power Company, incorporated a few weeks ago at Albany with a capital of $25,000,000.

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CONTENTS.

EDITORIAL NOTES.

Christmas. It is scarcely necessary to have chanted in our ears the stereotyped cry of "Christmas is coming and turkeys are fat; please drop a nickel in the newsboy's hat" to be reminded that to many the brightest and happiest day of the whole year is at hand. Even to those who have passed the meridian of life the pulse beats a shade faster at the mention of "Christmas," bringing back as it does memories that enhance the value of existence. To the young the day is one of unrestrained joy and good cheer; to the old, one of cordiality and thankfulness. And there is certainly much for which to give thanks this Christmas of 1898. Since the bells chimed forth the coming of Christmas day, 1897, one of the most eventful years in the history of this nation has come and gone. We have been engaged in a war from which we have emerged with honor and glory and with many square miles of new territory. A treaty of peace has lately been signed, which act again places us on a friendly footing with the nations of the world.

The business outlook would seem to be more promising than it has been for some time, and although the electrical industry has possibly not been quite so prosperous as might be desired, there is much for which to be thankful.

We wish all our readers, patrons, friends, a merry Christmas and many of them.

* * *

Elevator Accidents and Elevator Men. The recent deplorable elevator accident in which a well-known member of a New York fire insurance company was killed and several other persons seriously injured again brings up the question as to why such accidents are of such frequent occurrence in New York City. In the case in question it was stated that the accident was due to the automatic stop on the motor which operates the elevator not being properly set. Several hours previous to the accident this very elevator had been carefully examined by an inspector of the Building Department, and he had immediately reported, so it is stated, to the janitor that the stop was not properly adjusted, and yet in spite of this fact the elevator was kept in service. In the report submitted as to the cause of the accident it is further claimed that the operator failed to properly judge the distance to the ground floor. The car accordingly struck the bumper at the bottom of the shaft causing the back-draw weights to raise the car weights, thus tipping the latter into the elevator shaft. "Had the automatic stop on the motor been properly set for the down trip," says the report, "and had the car been properly stopped at the ground floor, the accident would not have happened." As near as we can see, both of the above conditions could readily have been fulfilled by the exercise of an ordinary amount of care. If, as the report states, the janitor of the building was notified that the elevator was out of order, it was his place and duty to discontinue the running of that elevator until it was put in repair. This tendency of running an elevator in which there is a piece of defective machinery, and thus unnecessarily risking the lives of the passengers cannot be too strongly condemned. As to why the elevator was not stopped at the proper time is another matter, and comes under the head of inefficient help, a subject on which we have animadverted time and again. The man who was in charge of the elevator at the time of the accident was from all accounts not the regular operator, but a substitute, and according to a statement made by a gentleman who was an eye-witness of the catastrophe, he (the elevator man) was more or less unfamiliar with the apparatus. Now, as we have stated many times before, life is too precious to be entrusted to ignoramuses. For this reason about a year ago, when the Building Department announced that all elevator men must pass an examination before being allowed to run elevators in this city, we applauded the step as being a movement in the right direction. The examination was held as scheduled, but unfortunately for the public it turned out to be scarcely more than a farce. To illustrate our meaning, here is a sample of the most important questions asked: "Name, age and residence? How long have you been running elevators? What make of elevators have you run? Where are you running now? What make of machine is it and how many are there? What is the carrying capacity of the car? How long are you on the car each day? Have you any other occupation? From whom do you take orders?"

A man answering the above "practical" questions in a satisfactory manner was then granted a license and entrusted with the lives of probably several hundred persons a day. It was apparently deemed unnecessary for an elevator man to know what the effect would be on the machinery were the lever thrown over too suddenly or the rope yanked too hard. As we have stated in previous editorials, however, although in many cases the employes in charge of the apparatus are directly responsible for the accidents, those who deserve the greater censure are the agents or even owners of the buildings, who, with a view to keeping down expenses, invariably seek cheap labor at the possible expense of human lives.

The Aims of the New York Gas & Electric Light, Heat & Power Co.

It must be apparent to every one that this is an era of large financial undertakings. About two months ago, or when the New York Gas & Electric Light, Heat & Power Company, with its $25,000,000 capital, was incorporated, we stated editorially that it was our opinion that the Metropolitan Street Railway Company was either directly or indirectly connected with the project, and from the information that has recently come to light it seems that we were not far out of the way in our surmise. Several of those interested in this new lighting project, as is now generally known, are closely identified with the Metropolitan Street Railway Company, and this will inevitably result in making the interests of these two mammoth corporations almost identical. The object apparently of the New York Gas & Electric Light, Heat & Power Company is to buy in or absorb the several lighting companies now operating in New York City and thus control the furnishing of electricity for lighting and power purposes. With this end in view the syndicate is said to have obtained control of the Consolidated Telegraph and Electrical Subway Company and of the Empire City Subway Company. Thus one of the principal difficulties which have heretofore stood in the way of new lighting and telephone companies, that of obtaining ducts wherein to run cables, has apparently been overcome. In the matter of obtaining control of the several lighting companies now doing business in New York City, the Whitney syndicate, as it is termed, has as yet not met with quite so much success, if general reports are to be credited. According to the latest information, what is known as the Mount Morris Electric Company has been absorbed, as well as several smaller companies, including, so it is thought, the Black Electric Light Company, which organization possesses a charter of considerable value; but the Westinghouse and the Edison electric lighting companies are holding out and refuse to sell. With these two companies out of the proposed light and heat trust, the lower end of the city will still be open to the keenest competition.

As near as can be gathered at the present time, and from statements that have been made, the plan of the New York Gas & Electric Light, Heat & Power Company is to purchase the surplus energy of the Metropolitan Street Railway Company's new plant and dispose of it to consumers. This plant, as is now generally known, will have a capacity of 70,000 horse power, of which probably the total output will be required but a few hours a day for operating the street railway systems. During the hours of light traffic the surplus current could be sold for heating, cooking or lighting purposes, which it is claimed is what will be done, the Whitney syndicate having obtained control of the subway companies as well as several lighting companies with this object in view. From the fact however that the New York Gas & Electric Light, Heat & Power Company but a few days ago purchased a block of land in the neighborhood of the Metropolitan Street Railway Company's power house, it would seem as though the new syndicate proposes to erect a plant of its own and generate current for lighting purposes far in excess of what could be purchased from the street railway company. In fact it is rather difficult to see how any very great amount of surplus current could be obtained from the Metropolitan Street Railway Company for lighting purposes owing to the heavy demand for operating the cars at about the time current would be required for lighting.

It may however interest some of our readers to know that, providing the new light and heat trust succeeds in monopolizing the electric lighting business throughout New York City, it will have a patronage amounting to about $3,000,000 a year, as this is the sum the electric lights are said annually to cost. It would seem after all as though the success of the undertaking would depend to a large extent on the favor of the city administration, as there is a law, if we are not mistaken, which permits the Sinking Fund Commission of New York City to purchase the subways at a price not exceeding 10 per cent. of the original cost.

* * *

The Lighting of New York City.

A number of accidents, due either directly or indirectly to the use of gas for lighting purposes, have been reported lately. A short time ago, owing to the escape of gas in the basement of the Capitol at Washington, an explosion occurred resulting in $20,000 damage. Fortunately no lives were lost, and with the exception of a few valuable reports destroyed everything can readily be replaced. Still more recently a fire broke out in a building on Broadway, New York, which resulted in the loss of several hundred thousand dollars, and was attributed, whether rightly or wrongly, to an explosion of gas in the cellar. Late in the afternoon of December 13 a new gas tank in course of erection for the Consolidated Gas Company collapsed while being subjected to a hydrostatic test, resulting in the death of at least six persons and the injuring of a score of others. Several buildings in the immediate neighborhood of the accident were totally demolished, and it is safe to say that the damage in this case will amount to several hundred thousand dollars. One or more of the supply mains were broken or choked up by the fall of the tank, resulting in the shutting off of the Consolidated Company's supply below Grand street in a part of the city where night work is most common. As this company furnishes most of the gas for lighting purposes in the lower part of the city, the latter was almost in total darkness, which served to reveal as probably never before how dependent the city is on the supply of gas for illuminating its streets. Excepting on a few of the principal thoroughfares electric lights were few and far between, which only goes to show how little after all electricity is being utilized for street lighting, at least in the business portion of the metropolis. It has been stated that the cost of electric lights for lighting the streets of New York City alone amounts to over $2,000 a night, and this being the fact, it is hard to realize it in view of the darkness into which a large portion of the city was plunged on the night of the 13th inst.

Among the down town business houses those which suffered the most through the accident to the Consolidated Company's mains were unquestionably the printing and publishing concerns. In many of these offices gas alone was made use of, which in a number of cases necessitated the leaving of important work undone or doing it with difficulty by improvised means. Accidents such as that of the 13th inst. are fortunately of rare occurrence, although the same results might be brought about at any time throughout the down town districts simply by a break in any of the principal mains. The knowledge of this fact and the experience recently gained would seem to emphasize the advisability of making use of electricity to a greater extent for lighting purposes. About the only accident which can befall a central power station and oblige it to shut down entirely is a conflagration, and even in such an event, which actually occurred in Newark a year or so ago, the street lights were again burning in less time than in the case of the recent deplorable gas accident in this city.

Another serious gas explosion has just been reported from Poughkeepsie, N. Y., in which at least two men lost their lives and an immense amount of damage was done. If these explosions continue to occur it may be that ordinary illuminating gas will have to be placed in the same category with acetylene gas and liquid acetylene.

Under the Searchlight.

Notes and Comments on Various Topics.

A NEW YORK inventor has discovered something much more serviceable than wireless telegraphy in its present stage of development, to wit, a device that is designed to lend additional charm and significance to the quotation from Young's "Night Thoughts," "tired nature's sweet restorer, balmy sleep"—in reality, an Electrical Bedbug Exterminator. In the last number of the Official Gazette of the Patent Office is recorded the grant of a patent bearing this title, the claims of which are formally set forth as follows:

1. The combination with a bedstead, of one or more pairs of electrical contacts consisting of strips surrounding the bars or framework of the bedstead and insulated from each other, whereby an insect, in traversing the bar or frame in the direction of its length, must necessarily close the circuit between the contacts, and a source of electricity connected with said contacts, substantially as described.

As we read this, the thought struck us that it might have some bearing on the recent boom in electrical schemes in the borough of Manhattan—the purchase of great distributing stations, subways, etc., and the incorporation of a multimillionaire company with electrical connections. May it not be that this was all due to the foreknowledge that such a patent was imminent, and that it would create an immense demand for electric current? What seems to confirm this view is the fact that the projected power stations of the syndicate are all to be located on the East Side, where the new device, from all accounts, ought to find an unlimited field of usefulness.

* * *

THE Rev. P. F. Jernegan of sea water gold fame and who is now sojourning in Brussels "for his health," has, so it is rumored, generously condescended to return about one-third of the total sum hypothecated from the Electrolytic Marine Salts Company. What a load this act must have lifted from his conscience?

* * *

SAN FRANCISCO advices state that an attempt at sending messages through space without wires was recently tried in that city and proved eminently successful. The experimenter was Prof. Albert Van der Naillen, who had only recently returned from abroad where he made a careful study of the system invented by Marconi.

* * *

SOME exciting scenes were witnessed at Cardiff, Wales, on an evening in November last, which, as reported in the local paper, almost rival those described in Mr. Bailey's story of an "An Italian's View of a New England Winter" in Mark Twain's "Library of Humor." As soon as one of the new electric lamps was lit, a portion of the pavement near the standard became charged with electricity, and the effect on pedestrians was startling and discomforting. The first victim was a terrier which was sniffing round. When it came in contact with the current, the dog gave a wild yelp, sprang into the air, and then scampered away squealing, with its tail drawn in. Next came an old lady carrying a parcel. When opposite the lamp she screamed with fright, dropped the parcel and hobbled off to examine her knees. A coal trimmer of unsteady gait followed, and on receiving the shock he stood still, and as his legs seemed to be getting on fire, he turned round in a dazed way, and went for the youngsters who were standing round laughing at what had now become a game for onlookers. A man lame with rheumatism leaped high into the air, and a smartly dressed young man knelt down to see what had happened to his foot, and as his knee received a shock, he sprang up and hurried away. By this time the workmen found that something was wrong, and the current was switched off.

THE CALORIFIC POWER OF WEATHERED COALS.*

BY R. S. HALE AND HENRY J. WILLIAMS,
Boston, Mass.

In 1896, samples of Maryland, Virginia, Pennsylvania and Ohio coals were collected and arranged for testing as follows: For tests of fine coal, the samples were ground in a coffee grinder, and thoroughly mixed and divided into two parts. For tests of lump coal, the coals were broken into lumps of about nut size, and alternate lumps taken from the pile to form two samples.

Having thus obtained two reliable samples of each coal, or four samples, where tests of both fine and lump coal were to be made, one sample was tightly sealed in an ordinary pint fruit jar, while the corresponding sample was exposed on an uncovered balcony out-of-doors for eleven months in an uncovered tin can provided with a diaphragm or bottom of fine wire gauze.

Rain and snow fell upon the coal, but the wire diaphragm permitted the water to drain off, while a paper disk placed upon the wire gauze prevented the coal from sifting through the meshes.

The percentages of sulphur are found on lines 5 and 6, while lines 7, 8, 9, 10 and 11 give the ultimate analyses, calculated to combustible. The British thermal units calculated from the analyses by the formula suggested by the boiler committee of the A. S. M. E., viz.: "146C + 620 $(H - \frac{O}{8})$ + 40S," appear on line 12, while the British thermal units interpolated from Kent's curve, which is based upon the per cent. of fixed carbon as found by proximate analysis, may be found on line 13.

Line 14 shows the per cent. of fixed carbon in the combustible. Lines 15 to 21 record the changes in the various quantities due to weathering, being plus for an increase and minus for a decrease.

Line 22 gives the free hydrogen, and line 23 its increase and decrease, due to weathering.

Finally, on line 24 the calorific power of three samples of the above coals, both sealed and exposed, as determined in Mr. Williams's bomb calorimeter, is shown.

The average of the results obtained shows that weathering, under the conditions described, decreases the percentage of carbon, hydrogen and nitrogen; increases the percentage of oxygen, and does not materially alter the percentage of sulphur.

When the weathered and unweathered samples are compared.

In a general way, the results show a slight diminution of calorific power in the grades of coal examined, directly traceable to weathering. They also show that where coals have not been exposed to oxidation, by weathering or otherwise, there is a reasonably close agreement between the results calculated by Dulong's formula and those obtained with the bomb calorimeter.

Last of all, they show that when it is desired to compare the respective calorific powers of coals that have been altered to a greater or less extent by oxidation with those of coals that have not been exposed to the weather, the use of Dulong's formula, or any of its modified forms at present in use, as well as the use of Kent's curve, would lead to erroneous conclusions.

	Coal.										
	Letter	b	A.	C.	D	P.	E.	R.	S.	J.	H.
	Name	Yorkville Lump, Portland, O.		Yorkville Lump, Portland, O.		Pittsburg Coal, Pennsylvania.		Pittsburg Coal, Pennsylvania.		New River, West Virginia.	
	Treatment	Sealed.	Exposed.	Sealed.	Exposed.	Sealed.	Exposed.	Sealed.	Exposed.	Sealed.	Exposed.
	Size	Fine.	Fine.	Lump.	Lump.	Fine.	Fine.	Lump.	Lump.	Fine.	Fine.
	Proximate Analysis.										
1	Moisture	1.61	1.91	1.21	1.07	1.36	0.89	1.07	1.39	0.53	1.19
2	Volatile matter	37.81	36.93	32.83	29.41	33.31	37.81	39.24	38.38	21.88	22.55
3	Fixed carbon	48.84	48.55	57.27	60.37	51.36	51.28	50.92	51.73	73.25	70.01
4	Earthly matter	11.74	12.61	8.69	9.15	8.97	10.02	8.77	8.50	4.34	6.32
	Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Sulphurs.										
5	Volatile	3.84	3.62	2.94	2.36	2.62	2.62	2.56	2.86	0.51	0.96
6	In ash	0.03	0.01	0.03	0.03	0.23	0.20	0.07	0.07	0.06	0.03
	Total	3.87	3.63	2.97	2.39	2.85	2.82	2.63	2.93	0.57	0.99
	Ultimate Analysis of Combustible.										
7	Carbon	78.94	79.59	83.54	82.55	81.24	81.56	82.47	82.15	88.72	88.05
8	Hydrogen	5.56	4.89	5.69	5.24	5.90	5.67	6.01	5.95	5.22	5.04
9	Nitrogen	1.52	1.54	1.63	1.64	1.79	1.69	1.88	1.62	1.74	1.78
10	Oxygen	9.55	9.75	5.87	7.94	8.16	8.14	6.81	7.10	3.79	4.08
11	Volatile sulphur	4.43	4.23	3.27	2.62	2.91	2.94	2.83	3.17	.53	1.04
	Total	100.00	100.00	100.00	99.99	100.00	100.00	100.00	99.99	100.00	99.99
12	B. T. U. calculated per lb. combustible: $[146C + 620(H - \frac{Ox}{8}) + 40S]$	14,406	14,065	15,403	14,792	15,008	14,908	15,353	15,260	15,913	15,706
13	B. T. U. Kent by interpolation	13,900	13,980	15,160	15,400	14,220	14,200	13,900	14,120	15,820	15,900
14	Per cent. fixed carbon in combustible	56.5	56.9	68.6	67.0	58.0	57.8	56.5	57.5	77.2	75.8
15	Increases—Carbon	+ .65		− .99		+ .32		− .32		− .67	
16	Hydrogen	− .67		− .45		− .23		− .06		− .18	
17	Nitrogen	+ .02		+ .01		− .10		− .26		+ .04	
18	Oxygen	+ .20		+ 2.07		− .02		+ .29		+ .29	
19	Sulphur	− .20		− .65		+ .03		+ .34		+ .51	
20	B. T. U. by formula	− 341		− 611		−95		− 93		− 208	
21	Fixed carbon	+ .4		+ .34		− .2		+ 1.0		− 1.4	
22	Free hydrogen	4.87	3.67	4.96	4.25	4.86	4.65	5.16	5.06	4.75	4.53
23	Increase	− .70		− .71		− .23		− .10		− .22	
24	Calorimeter (William's bomb)	....	....	15,461	15,301	....	....	....	....	....	....

	Coal.								
	Letter	K.	J.	O.	N	L.	M.	G.	P
	Name	Nickel Plate, McDonald, Pa.		Nickel Plate, McDonald, Pa.		George's Creek, Cumberland, Md. Run of Mine.		George's Creek, Cumberl'd, Md. Run of Mine.	Pocahontas Run of Mine.
	Treatment	Sealed.	Exposed.	Sealed.	Exposed.	Sealed.	Exposed.	Indoors Three Years.	Exposed Three Years.
	Size	Fine.	Fine.	Lump.	Lump.	Fine.	Fine.	Fine.	Fine.
	Proximate Analysis.								
1	Moisture	2.02	1.46	1.77	1.71	0.95	0.70	0.79	0.94
2	Volatile matter	34.19	34.84	37.16	34.12	20.20	17.58	18.56	17.81
3	Fixed carbon	53.71	52.64	52.63	53.70	73.10	73.95	73.14	74.19
4	Earthly matter	10.08	11.06	8.44	10.47	5.75	7.77	7.51	7.06
	Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Sulphurs.								
5	Volatile	0.95	1.27	1.71	1.57	0.81	0.82	1.26	0.62
6	In ash	0.06	0.05	0.02	0.01	0.03	0.01	0.05	0.06
	Total	1.01	1.32	1.73	1.58	0.84	0.83	1.31	0.68
	Ultimate Analysis of Combustible.								
7	Carbon	81.45	81.33	83.50	82.41	88.85	88.38	88.90	91.15
8	Hydrogen	5.62	5.67	5.67	5.74	5.19	4.77	4.82	4.75
9	Nitrogen	1.66	1.67	1.79	1.67	2.07	1.60	2.04	1.23
10	Oxygen	10.19	9.88	7.13	8.39	3.03	4.35	2.87	2.15
11	Volatile sulphur	1.09	1.45	1.90	1.79	.87	.89	1.37	.66
	Total	100.01	100.00	99.99	100.00	100.01	99.99	100.00	100.01
12	B. T. U. calculated per lb. combustible: $[146C + 620(H - \frac{Ox}{8}) + 40S]$	14,622	14,685	15,231	15,011	15,969	15,562	15,799	16,113
13	B. T. U. Kent by interpolation	14,830	14,670	14,300	14,860	15,840	15,840	15,840	15,840
14	Per cent. fixed carbon in combustible	61.2	60.4	58.5	61.4	78.2	80.6	80.0	80.6
15	Increases—Carbon	− .12		− 1.09		− .47			
16	Hydrogen	+ .05		+ .07		− 0.42			
17	Nitrogen	+ .01		− .12		− .47			
18	Oxygen	− .31		+ 1.26		+ 1.32			
19	Sulphur	+ .36		− .11		+ .02			
20	B. T. U. by formula	+ 63		− 220		− 427			
21	Fixed carbon	− .08		+ .29		+ 2.4			
22	Free hydrogen	4.85	4.44	4.78	4.69	4.31	4.23	4.46	(4.48)
23	Increase	+ .09		− .09		− .08			
24	Calorimeter (William's bomb)	....	....	15,240	15,200	16,048	15,958		

The lump samples were exposed in pans of much larger size, which were provided with holes to let the water drain off.

This method of exposure closely reproduces the conditions to which the surface of a pile of coal left out-of-doors would be exposed. The interior of such a pile, however, would suffer less than the samples.

At the end of eleven months all the samples were analyzed by Mr. Henry J. Williams, together with a sample of Pocahontas coal that had been exposed in a coal yard for three years, and one of Cumberland coal that had been under cover for three years. These last coals, however, being different, are not comparable with each other.

The results of the above analyses are shown in the accompanying table.

Proximate analyses of the coals may be found on lines 1, 2, 3 and 4.

In these analyses the percentages of ash in some of the exposed samples are unfortunately too high, for a little gravel was accidentally washed off the roof of the house, by the rain, into some of the cans. This, however, in no way affects the relative percentages of combustible matter, free from ash.

The conclusions to be drawn from an examination of the results shown are:

1st. That weathering decreases by about two per cent. the theoretical calorific power, as calculated by Dulong's formula.

2d. That weathering decreases by about one-half of one per cent. the actual or true calorific power, as shown by the three results obtained with the bomb.

3d. That if the results calculated from the above analyses are interpolated from Kent's curve, which is based on the per cent. of fixed carbon as determined by proximate analysis, the latter being a more or less variable quantity according to the age and degree of exposure of the coal, the remarkable result is obtained that the weathering of a sample of coal *increases* the percentage of fixed carbon in the combustible, and also *increases* by about *one per cent.* the calorific power of the coal.

It may be noted that the English form of Dulong's formula, which neglects the term $\frac{O}{8}$, but uses slightly lower values for the heat of combustion of C and H, would cause the calorific power, as computed, to agree more closely with the results obtained with the bomb than the formula "146C + 620 $(H - \frac{O}{8})$ + 40S." This is especially noticeable

*Presented at the New York meeting (December, 1898) of the American Society of Mechanical Engineers.

Municipal Ownership.

Thomas J. Kelly, president of the Horace Bushnell Sociological Club, delivered an address in Hartford, Conn., a few evenings ago on "Municipal Ownership of Natural Monopolies," taking the ground that municipal ownership of street railways, gas and electric lighting plants and any other natural monopoly was not for the benefit of the community. Mr. Kelly claimed that municipal ownership of gas plants had not been a success in this country, although twelve cities owned or had owned their plants. There is not a city in this country which owns its street railway plant and we are twenty-five years ahead of any country in Europe in the operation of street railways, so no comparison can be made with railways in European cities which own their street railway plants. In Glasgow, Scotland, where the city a few years ago acquired the street railway, it is still operated by horses, and although the fare is but one cent a mile it would cost 71 cents to travel over the 71 miles of track in the city. In Hartford you can travel ten miles for 5 cents. Mr. Kelly quoted the city of Philadelphia among other cities as having given up the municipal ownership of gas plants after fifty years. He claimed that municipal ownership of natural monopolies was simply political monopoly. He said the only proper system of treating the problem was by the sale of the franchise for a period of years to the highest bidder, with an annual tax upon the gross receipts, as prevails in Toronto, where a large income is assured the city from the franchise of the street railway company.

THE CATARACT POWER COMPANY OF HAMILTON.*

Saturday, November 12, will go down in the electrical annals of Canada as a red letter day, as it will chronicle the formal opening of the electric power plant of the Cataract Power Company of Hamilton, Limited, for the transmission of electrical energy from a point on the Niagara escarpment near DeCew Falls to Hamilton, a distance of 35 miles, the conception and carrying out of which must always stand as a monument of business pluck and enterprise on the part of those interested in and forming the Cataract Power Company.

Over three years ago, when the transmission of energy by electricity over long distances for commercial purposes was still in much of an experimental stage, the possibility of utilizing the magnificent fall of over 200 feet obtainable at DeCew Falls, where the waters of the Beaver Dams creek tumble over the Niagara escarpment, for the generation of electrical energy to be transmitted to the city of Hamilton, 35 miles distant, suggested itself to Mr. John Patterson of that city. After numerous surveys and examining into the physical feasibility of the scheme, he associated with himself the Hon J. M. Gibson, John Moodie, Sr., James Dixon and J. W. Sutherland, all well-known citizens of Hamilton. Together they procured a charter and formed the Cataract Power Company of Hamilton, Limited, for the purpose of the development of this power and the transmission of it to Hamilton.

After the formation of the company the ground was again gone over carefully and it was found advisable to abandon the original idea of utilizing the waters and water-ways of the Beaver Dams creek and the De Cew Falls, and by changing the plans some very material advantages were gained:

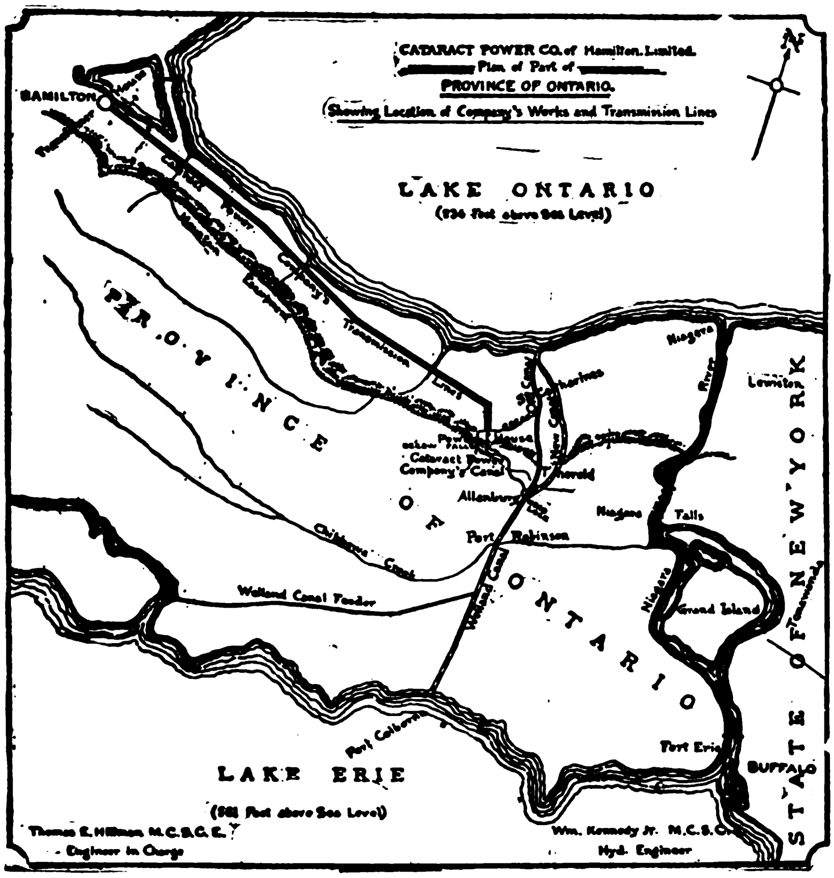
First, the securing of a supply of water which would be constant, through a feed er from the Lake Erie level of the Welland Canal at Allanburg.

Second, the construction of a canal, 4¾ miles long, over private right-of-way, thus giving the company an unobstructed water-way.

Third, the securing of land along the private water-way for storage basins, by which the company can conserve its water at a period of non use or light load for use at the time of heavy load.

Fourth, by going three-quarters of a mile east of De Cew Falls along the Niagara escarpment, an additional fall of 70 feet was obtained, which was a very valuable acquisition. At this point there were also exceptional natural advantages, both at the top of the escarpment for the anchorage of flumes, erection of penstocks, etc., and at the foot of it for the discharge of the tail water, as well as a splendid site for the power house.

The hydraulic development, as it was desired by the Cataract Power Company, presented obstacles which, owing to the large units and to the high head, made it exceptionally difficult to secure a builder of water-wheels who would give what the hydraulic engineer's specifications called for. After a long delay and much negotiation, however, a Dayton, O., concern agreed to build special horizontal turbines of about 2,000 horse power each, to work under a head of 265 feet, and to operate at a speed of 400 revolutions per minute. This required, also, special valve and valve gear and controlling devices, all of which were specially designed for this particular plant.



The generation of the electric power and the transmission of the same from the power house to the city of Hamilton, a distance of 35 miles, presented at that time a seemingly insurmountable obstacle to the carrying out of the scheme, no transmission of energy such a long distance, for commercial purposes, having up to that time been undertaken. The largest electrical concerns, both in Europe and America, were consulted, but the limitation of a practical working pressure, sufficiently great to insure the transmission of power such a long distance, practically precluded the undertaking of the work by many of the companies consulted, the highest working pressure, up to that time, being not above 10,000 volts. At this pressure the cost of the transmission line became so great that the Cataract Power Company did not feel warranted to undertake the development of the enterprise. The longer the distance, the heavier the conductor must be; therefore to transmit over this long distance it was necessary that the pressure be 20,000 volts or over, so that the cost of the conductor would be within the limit set to allow the Cataract Power Company to undertake the development of the enterprise. After nearly a year of futile attempts to have the work undertaken at a pressure which would justify them in proceeding with the work, and being unsuccessful, they consulted Mr. J. A. Kammerer, one of the staff of the Royal Electric Company of Montreal, and after careful consideration of the conditions, and preliminary estimates of cost prepared by him, with a working pressure of 24,000 volts guaranteed, the Royal Electric Company agreed to undertake the work which, with its consequent saving, brought the cost within the limits deemed necessary by the Cataract Power Company to admit of the enterprise being proceeded with.

Ground was first broken on October 5, 1897, and the work pushed with such vigor that the current was sent over the lines from De Cew Falls to Hamilton on the afternoon of August 25, 1898, or just 10 months and 10 days from the beginning of the undertaking.

THE CANAL.

The water for this plant is secured through a feeder from the Lake Erie level of the Welland canal at Allanburg. The arrangement of the gates, is such as to admit of the unwatering of the lower levels of both the old and the new Welland canals without interfering with the company's supply of water.

From Allanburg the company has a private canal extending northwesterly to the edge of the Niagara escarpment, a total distance of about four and one-half miles.

FIG. 1.
Flume over Beaver Dams Creek.

At three different points there are placed gates for regulating or shutting off the supply, so that the water is under complete control. Where the canal crosses the Beaver Dams creek, the water is carried in a closed wooden flume supported on a steel truss. This flume, which is shown in Fig. 1, is placed below the level of the water in the canal at each end so that the contained water is always under pressure, which is intended to prevent leakage. The water follows generally the water courses of a succession of small streams, consequently there are few heavy cuts or fills. In a number of places the contour of the ground formed a natural bed for the canal, and no work was necessary. At the heavy cuttings the banks to the bottom of the canal are pitched with stone, and the important embankments are rip-rapped to prevent erosion.

At the lower end of the canal near the mountain top are located three large storage reservoirs, having a total area of thirty-three acres. Two of these are known as lakes of Moodie & Gibson, the former being shown in Fig. 2. These three reservoirs are sufficient to contain forty-eight hours' supply of water, and will meet the hourly inequalities of demand usual in electric supply companies, as well as allowing the unwatering of the upper stretches of the canal for repair purposes, without the interruption of the company's service. Throughout the whole length the work is of particularly substantial character, the factor of safety being exceptionally large, and the requirements of the service seem to have been carefully considered.

The large reservoirs, being located immediately at the mountain's edge where the water enters a steel pipe, the long stretches of slow current canal will it is expected promptly freeze over and prevent any trouble from frazil or anchor ice. In this mat-

* Abstract from *Canadian Electrical News*.

ter the water power is particularly fortunate, as there is practically dead water to Lake Erie. The canal is designed to carry sufficient water to develop from 10,000 to 12,000 horse power without creating an erosive speed in the current.

THE PIPE.

At the brow of the mountain the water is delivered through a concrete fore bay, protected by suitable racks and head gates, to a large steel pipe which carries it directly down the mountain slope to the power house, 260 feet below. The pipe is of steel plate, double riveted on both longitudinal and transverse seams. It is 745 feet in length and varies in diameter from 8 feet 6 inches at the top to 7 feet 6 inches at the bottom. The steel used for the top section is ½ inch in thickness and gradually increases in size down the slope until at the bottom it is 13-16 of an inch. The weight of this pipe is all supported from the top, where a number of heavy flanges are built into several piers of concrete placed in the rock cutting. Down the slope, at intervals of 15 feet, supporting masonry foundations are constructed. A substantial double housing of matched lumber is now being built over the entire length to protect the pipe from extreme changes of temperature.

About two-thirds of the way down the slope is placed an expansion joint to take care of any elongation or contraction. In addition to serving this purpose the joint is so designed as to support the part of the pipe below it. This is accomplished by means of the water pressure acting against an annular piston attached to the lower section, the piston working in a cylinder attached to the upper section.

From the top the pipe runs downward at an angle of about twenty degrees for about two-thirds of its length, where it reaches a level bench about 60 feet wide and then continues downward at the same slope to the bottom, where it turns with a gentle curve almost a right angle and extends underneath the floor of the power house.

POWER HOUSE.

The power house building (Fig. 3) is a substantial structure of iron and brick, 174 x 42 feet, with a galvanized iron roof over matched board sheathing. It is designed to accommodate four complete generating units and the necessary step-up transformers, switchboard, etc. Only two units and half the capacity in transformers are at present installed. The building is lighted by clusters of incandescent lights and will be heated by electric heaters.

The main supply pipe enters at the end of the building below the floor level, and inside the building widens out into a steel receiver 10 feet in diameter, which is solidly imbedded in concrete underneath the floor. From this receiver four branch pipes come up through the floor with a quarter turn for delivering water to the turbines. In these branch supply pipes are placed large vertical hydraulic gates. These gates are 36″ in diameter, and are operated by hydraulic pressure by means of a four-way valve, controlled by a lever. These valves will open or close in less than a minute. Beyond each gate valve is placed a 12″ spring relief valve, to relieve the pressure when it exceeds that due to the normal static head. The turbines are 1,950 HP. each, and run at 400 revolutions under the normal head of 280 feet.

The water wheels are of the inward flow central discharge reaction type, with cylinder gates. We believe that this is the highest head employing this type of turbine, most of the high head plants using the jet or impulse peripheral bucket design wheels. In order to withstand the unusual pressure, the runners, the gates and all parts susceptible to wear are made of bronze, and everything is made extremely heavy and has been specially designed for this plant. The water enters the wheel horizontally and discharges vertically downward through a draft tube 14 feet in height. Each unit is equipped with an electric governor of the Giessler design for controlling the speed. On the outer end of the shaft is placed a 7½ ton steel fly wheel with an outboard bearing. The combined influence of the enlarged receiver, the relief valves and the heavy fly wheel is calculated to overcome any tendency to water hammer.

ELECTRICAL EQUIPMENT.

The electrical equipment marks a long stride forward in the progress of electrical engineering as applied to transmission of energy. The generators are of the well-known S. K. C. inductor type, generating two-phase current at 2,000 volts, running at 400 revolutions per minute. Each of the two generators at present installed is of 1,000 KW. rated capacity. They are connected direct to the turbine shaft by means of an insulated flexible coupling composed of two flanges with projecting pins, the alternate pins being joined by sole leather links. The generators rest on base frames of seasoned Georgia pine to insulate them from the foundations. The inductors of these machines weigh over twelve tons, which weight running at such a high speed requires most careful workmanship. The entire absence of vibration and general smoothness of operation are certainly creditable to the manufacturers.

The wires connecting the generators to the switchboard are laid in conduits in the floor, which are covered with iron griddles so that they are accessible at any point.

There are two exciters of 30 KW. capacity, each driven by a separate turbine. Each exciter is calculated for supplying the full equipment of four generators. They are likewise directly connected to and insulated from the turbines.

The main switchboard is made up of three white marble panels, one for each generator and one for the exciters. On the generator panels all the connections are made on the back of the board, there being no terminals on the face. The switches are of the S. K. C. slide quick break type and are provided with automatic shutters to prevent arcing. They are double throw, connecting to two separate sets of bus bars so that the machines may be run on separate lines or in parallel, according to the future requirements of the service. Each generator panel contains a voltmeter with a double throw switch connected to both phases, an ampere-meter on each phase and a direct current ampere-meter in the field circuit of the generator. The cases of the instruments are made of ground glass and present a very attractive appearance. The exciter panel contains the usual instruments for operating two shunt wound direct current machines in parallel, and also contains the synchronizer, which is of the ordinary three lamp type.

A special feature is the absence of generator fuses. As the S. K. C. generators supplied were made especially to withstand a heavy overload it was considered safer to risk the strain upon the generators due to a short circuit rather than by the blowing of generator fuses to cause the instant removal of the entire load from the water wheels.

Immediately back of the switchboard and taking up one end of the building are located ten of a new type of S. K. C. transformers, used to raise the potential relieved by the generators to 22,500 volts on the transmission line, at which pressure it is at present operated. These transformers are arranged in batteries of five, each transformer having a capacity of 200 KW. They are artificially cooled by means of water supplied directly from the penstock, the pressure being reduced by means of throttle valves. The transformers are encased in tanks made of steel boiler plates and rest directly on the concrete floor. The coils are wound in sections carefully insulated and separated by unusually large air spaces, and the whole immersed in mineral-seal oil. This construction has been found to admirably answer the purpose of this exceedingly high voltage, each transformer being tested with a break down strain of 40,000 volts before being installed.

A novel feature of the installation is the switchboards, which accompany each transformer. They are of specially selected white marble and contain two single pole high voltage switches and one double pole 2,000 volt switch, the two high voltages being separated by a marble barrier. The high voltage switches consist of a flexible cable, having a screw plug attached to one end and a socket to the other, the socket being attached to a hardwood pole four feet in length for safe handling. The socket and the plug which it fits over are tipped with non-arcing metal. By means of these specially constructed switches the 22,500 volt circuit can readily be opened. The low voltage switches are of the S. K. C. slide quick break type on the back of the switchboard. Each transformer is also equipped on both the primary and secondary sides with enclosed non-arcing fuses. The 22,500 volt wires inside the building are all covered with a specially heavy insulation of rubber and are supported on porcelain line insulators on an overhead rack, all being in plain sight and easily accessible.

From the transformers, which are connected five in parallel on each phase, the circuit runs to the line terminal board, consisting of four high voltage switches similar to those placed on the transformer, except that they have double terminals, in order that they may be changed to either of the two lines contemplated by the company. Immediately above the line terminal board is placed a specially constructed lightning arrester equipment composed of 60 S. K. C. non-arcing arresters with their special appurtenances and connections. From the lightning arresters the wires pass upward and out through the wall of the building at a height about 30 feet from the floor.

THE TRANSMISSION LINE.

The high voltage wires are carried through the brick wall forming the gable of the power house, by means of lead-encased rubber-covered cables, protected by vitrified pipe, the cable being kept clear

FIG. 2.—STORAGE RESERVOIR NO. 1, LAKE MOODIE.

of the pipe by wooden bushings specially prepared in oil. After passing over a cross-arm attached to the building, the lead-covered cable is joined to the bare copper transmission wires by means of a long, carefully made water-proof joint. This special construction has proven entirely satisfactory.

From the power house the transmission line crosses the Twelve Mile creek and runs up the hill opposite on private property to a concession road, thence along this roadway due north to the Grand Trunk Railway and then westward along the railroad right of way on an almost perfectly straight line to the company's step-down station at Hamilton, a total distance of a little less than 34 miles. The transmission wires are four in number, and are No. 1 B. & S. medium drawn bare copper. They are all placed on one four pin cross-arm 3¾ x 5¾", spaced 18" apart, and are supported on porcelain insulators of the Redlands type. The pins are of special design, holding the insulator two inches higher from the

FIG. 3.—GENERAL VIEW OF POWER HOUSE AND PIPE.

cross-arm than the standard practice. This is to avoid trouble from heavy snow or sleet. The pins are of yellow locust specially prepared in oil, and are fastened into the cross-arm with a wooden pin instead of being nailed, so as to use as little iron as possible.

The poles are all specially selected, with 8" tops and not less than 35 feet in length. They are set 90 feet apart and 6 feet deep in the earth. The height of the poles varies with the contour of the ground, so as to keep the wires as nearly horizontal as possible. In marshy places a crib filled with stone is built around the base of the pole, and where the line crosses the Jordan river the poles are placed in a cluster of piles specially driven for the purpose. On the top of the poles is run a galvanized iron barb wire grounded at every pole by means of an iron plate for lightning protection. Below the transmission cross-arm is placed a two-pin cross-arm carrying the telephone circuit.

The telephone circuit is a complete metallic circuit of No. 10 B. W. G. galvanized wire, transposed at every fifth pole. This arrangement has been found to give satisfactory service with the heaviest currents yet passed over the line.

The insulators were all carefully tested with a break-down pressure of 60,000 volts, both at the factory and again at Hamilton, before being put up, with the satisfactory result that not one has broken down or produced the slightest trouble in the three months during which the line has been in operation, notwithstanding the unusual rain and sleet storms during that period.

TRANSFORMER SUB-STATION AT HAMILTON.

The company's step-down station is located on Victoria avenue, immediately beside the Grand Trunk Railway's right of way, about one mile within the city limits. It is a neat structure, built of brick with a slate roof and specially designed for its purpose. At this point the voltage is reduced to 2,000 volts at which pressure the current is distributed through the city in four separate circuits.

The line wires are carried through the brick walls of the building in the same manner as at the power house. There is the same arrangement of lightning arresters, high voltage lines and two batteries of transformers. The transformers, however, are arranged so as to be artificially cooled at times of heavy load by an air blast. The transformers rest over an air duct in the floor and are provided with a ring of vertical air ducts passing up through the oil. The blast arrangement, which consists of a No. 6 Sturtevant blower, direct connected to an S. K. C. two phase induction motor, delivers air directly into this duct which then passes upward through the transformers.

In the transformer room is also placed the distribution switchboard, and, as at the power house, only half the ultimate capacity of the transformers has been installed, the building being designed to accommodate two more batteries of five, similar to those already placed, consisting of four panels each, containing two ampere-meters, two double pole double-throw switches and four duplex fuse blocks. From this distribution switchboard incandescent lighting current is supplied for the Hamilton Electric Light & Power Company, as well as for motors on premises of customers throughout the city. From the switchboard the circuit wires pass upward to a cupola in the roof, at which point they are joined to the distribution circuits. The line supplying the incandescent service is a four-wire two-phase circuit, but the circuits devoted exclusively to power are composed of three wires only.

At the premises of the Hamilton Electric Light & Power Company is being installed a new circuit switchboard, arranged to accommodate the old single-phase lighting circuits of this company. Each circuit is equipped with a double-throw switch in order that the load may be divided with a regulating transformer, so that the pressure may be controlled upon this point. The old house-to-house 1,000 volt 16,000 alternation transformers have all been replaced by new S. K. C. 2,000 volt 8,000 alternation transformers in larger units, and the service all changed to this higher pressure in order to reduce the losses and obtain better regulation.

In addition to supplying the Hamilton Electric Light & Power Company's service, the Cataract Power Company have already contracted for a large amount of power for operating factories of different kinds in the city. They expect within a short time to supply the various electric railways in and about Hamilton and to replace many of the steam engines in the various manufacturing establishments with electric motors.

The plant has been in practical operation for several months, and has thoroughly demonstrated the success of electrical transmission at this high voltage and long distance, which speaks well for the carefulness in designing and construction of the work.

ELECTRICITY IN THE WAR.*

The lessons taught by the late war with respect to the employment of electricity aboard men-of-war are few in number, though important in their bearing. The most decisive result was the demonstration of the immense superiority of electricity over steam for the operation of turret-training apparatus —a demonstration so decisive, in fact, that the question of the employment of electric power for this purpose is no longer an open one. The Society is to be congratulated that one of its members is the inventor of the system whose application has led to this happy result. I refer to Mr. H. Ward Leonard.

Another question which the test of battle has settled definitely is the superiority of electric ammunition hoists, not only in efficiency in working, but in a convenience with respect to location and space occupied that will tend to greatly extend the application of electric power on shipboard generally.

Against the great success in the particulars just mentioned must be set the failure of electrical range-finding apparatus, and of electrical indicating apparatus in general. As to the first mentioned, the enemy gave so few opportunities for its use, and even then so little necessity existed for its employment in view of the leisurely manner in which our vessels could pick up their range, that possibly neglect had something to do in the case.

At any rate, electrical range-finding should not be condemned in general because of the failure of a single system. In fact the weak points in the one in question would seem to be easily overcome by the employment of alternating currents of high frequency and considerable voltage, thereby enabling a drop between indicating points to be obtained by means of inductance which would be in the order of volts instead of possibly millivolts as where the direct current is used. I will add that an apparatus somewhat answering this description has been proposed by Messrs. Crehore and Squier.

As to other indicating apparatus, it should be borne in mind that electrical apparatus of this nature requires a certain amount of expert care which it is not always possible to obtain aboard ship, while the contrary is the case with the mechanical apparatus that it would displace. If in anticipation of battle the latter is thoroughly overhauled, as would be the case, there is more assurance of its efficient working than electrical apparatus under the adverse condition named, notwithstanding the inherent superiority of the latter. This brings up the question of the deficiency aboard ship of necessary electrical skill, which has been made the subject of an official report by the bureau officer in charge of electrical engineering, and will be referred to later on.

The favorable experience with electric power in the important cases just mentioned should accelerate the extension of its application aboard ship, and while, unfortunately, the present bureaucratic tendency is not in that direction, I shall nevertheless refer to some other cases distinctly calling for such application.

The one of immediate importance, and which in fact can be considered a crying necessity, is that of electric ventilation.

For warship ventilation, both with respect to coal economy and deriving the most efficient results in ventilation itself, the electric fan offers an ideal solution. The modern warship being divided into numerous compartments, each of these can be supplied with its own electric fan or fans, either for isolated ventilation or to supply a system of only such extent as will involve no sacrifice in efficient ventilation. The type of engine now employed with steam ventilators undoubtedly requires anywhere from 75 to 200 pounds, and even more water per horse-power hour. In the case of a large electric plant and with

* An address by W. D. Weaver, late Chief Engineer of U. S. S. Glacier, before the New York Electrical Society, Dec. 14, 1898, on "Electrical and Engineering Work in the Navy during the War."

fan motors of the most ordinary efficiency, this would be reduced to considerably below 50 pounds, while at the same time the ventilation for a given expenditure of power would be greatly increased in efficiency.

Whether electricity should be applied to furnace blowers for forced draught is an open question at the present moment, in view of the very infrequent use of such blowers and consequent large idle electric plant normally that would be entailed.

Other employments of electric power so obvious that their adoption cannot be greatly delayed, are in driving the workshop and ice machine now installed aboard every warship. The engines of the latter are particularly inefficient, aside from their immense inconvenience through the heat given forth. In these cases the application of the electric motor is so simple that it cannot be open to question, and the same remark applies to winches and ash hoists. On the ship of which I was chief engineer there were six of these, which I estimated consumed steam at the rate of over 150 pounds per horse-power hour, not counting the great condensation in the long lengths of steam-supply pipes.

Steam pumps are, as is well known, grossly inefficient in steam consumption, and the same is true to a lesser extent of other auxiliary machinery connected with the propelling engines. While it may be claimed that it would be inadvisable to render the operation of the propelling machinery, particularly in time of battle or during storms, dependent on obtaining power from the electric mains, in reply it may be said that the number of different engines at present employed to run the auxiliary machinery is in itself a great hazard, for the breaking down of almost any one would alone affect the operation of the main propelling machinery.

Among other probable applications of electricity in the future are to anchor hoists and steering gear. The navy has had a somewhat unfortunate experience with the latter, and this, by the way, carries a lesson with it for those interested in introducing new electrical machinery aboard warships.

The lesson is, that in every case possible such machinery should first be tried aboard merchantmen and all experimental work entirely completed before attempting to secure adoption by the navy. In many cases it would possibly not be a difficult matter to find opportunities for making the trial on coastwise or freight steamers, or on harbor vessels, though sometimes, however, at the expense of those putting the apparatus aboard.

Steering gear and anchor hoists now furnish good subjects for the electrical designer, and if previously tested in the manner described would undoubtedly stand an excellent chance of adoption for use in the navy in the near future.

As I have intimated, it must be reluctantly acknowledged that, notwithstanding the extremely efficient showing electricity made during the late war, it is apparently at the present moment not in high favor at the Navy Department. The Chief of the Bureau having charge of electrical matters has recently reported very gloomily concerning the difficulty experienced aboard ship in keeping the generating plant in an efficient state; and the Naval Board of Construction has refused to further extend the application of electricity on shipboard, the decision being that the use of electricity has gone far enough for the present.

It is quite probable that this unfortunate decision was arrived at owing to the unfavorable condition referred to concerning efficient operation. Why the operation of an electric plant of the size installed aboard ship should present any considerable difficulty will probably be a puzzle to those here present who are conversant with electrical operation ashore, as it would also to those familiar with merchant ship electric lighting. The clue is given, however, in a remark by the Bureau Chief as to the difficulty met with in obtaining an efficient operating force, the fault thus lying, it is to be surmised, not with the electrical apparatus, but with the electrical personnel.

In view of the manner in which professional pride and the electrical industry are thus affected, it would appear entirely appropriate for the electrical fraternity to use its influence to have the appropriate remedy applied to the serious defect which has thus been officially acknowledged to exist. What this remedy should be might well prove the subject of a Departmental or even of a Congressional investigation. That it is due to a faulty system, and not chargeable to lack of zeal on the part of the officers affected, can, I believe, be taken for granted.

NEW SCHEDULE FOR NIAGARA POWER.*

The Cataract Power & Conduit Company will, it is understood, about the first of the New Year, promulgate a new schedule of rates which will be more favorable to the user of power than the one now in vogue, which was announced last April. It should be stated here that the officers of the company decline to confirm this statement and it is given without their authority. It will readily be understood that the company will announce its new and reduced schedule when it gets ready, and not before.

The reason why a new schedule will be inaugurated is plain. There is a great deal more power ready and waiting for delivery in Buffalo than there was a few months ago, and there has been a constant improvement in the facilities for delivery. With all the facilities completed both at Niagara Falls, the seat of the power, and in Buffalo, for distribution of the same, and a transmission line capable of carrying some thousands more horse-power than is now in use here, it stands to reason that the big company which produces the power and the local company whose province it is to distribute it will come to an understanding in the direction of cheaper rates. After all the vast machines, shafts, canals, power houses, transmission lines, conduits, distributing stations and other needed paraphernalia are established, so that the water of the great cataract will do the rest, there will naturally come a desire on the part of the power people to market their product. The way to make a market for all of it is clearly to offer such inducements that other forms of power will not be in the race. This will be done. The arrangements have proceeded quietly and without ostentation, but Niagara power will be the great power of the world. There are other cataracts and other electric power plants, but there is only one Niagara. There is only one great city that has any such advantage as Buffalo—only one combination of practically unlimited cheap power and shipping facilities equal to the best on earth.

POWER NOW USED IN BUFFALO.

The motors already installed in Buffalo have an aggregate capacity of about 4,500 horse-power. They include: Buffalo Railway Company, 2,000 horse-power; Great Northern Elevator, 1,200 horse-power; Union Dry Dock, 485 horse-power; Electric Elevator, 475 horse-power; Curtiss' Malthouse, 300 horse-power. Besides this it is estimated that the Buffalo General Electric Company will use 3,000 horse-power. It is already using 400 or 500 horse-power and the change is gradually being made which increases the amount used. The Urban Milling Company will use 300 horse-power and the machinery for this purpose will be in place in three or four weeks. A contract has been made with the McKinnin Dash Company for 100 horse-power, and negotiations are under way for further contracts. The Cataract Power & Conduit Company could furnish at this time 10,000 horse-power and by January 1 it will be able to provide 15,000 horse-power. It will be seen from the figures given that the amount of power actually in use and contracted for is about 7,900 horse-power.

HOW THE CURRENT IS HANDLED.

The electric current from Niagara Falls is received at the transformer stations in Seventh street, adjoining the General Electric Company's new Wilkeson street plant, at 10,000 volts three-phase current. There are duplicate circuits, so if an emergency comes where one fails another can be used. The current goes through switchboards and then to transformers, which reduce the current to a pressure of 370 volts, still three phase. Next the electric energy comes into the General Electric Company's building on very heavy copper cables, and thence is distributed to motors which are directly connected to generators of various types. Some of the generators are used in street lighting, some are for incandescent lighting and others for supplying 500-volt power for small factories, for motors up to 50 or 60 horse-power.

This power will be distributed all over the city at the usual pressures the company has been utilizing and in a similar manner, so the motors used for Niagara power will simply take the place of engines and boilers, the power itself not being suitable for lighting, but only for motive power.

All the remaining cables needed by the Cataract Power & Conduit Company are ready to be shipped. They will be connected with the different transportation stations. One important piece of machinery needed by the company arrived the first of this month —13 months after it was ordered. It takes time to install a new plant of this magnitude.

The present schedule of rates of the Niagara Power & Conduit Company makes the power cost $22.35 per horse-power per year, supposing the consumer uses 80 horse-power. It is the cheapest power in the world and the most desirable. Cheap power combined with the wonderful shipping advantages of Buffalo will build up a vast manufacturing city here unless there is some strange and undue counteracting influence to work to Buffalo's detriment. There are 35,000,000 people within a night's ride of this city. Following is the distributing company's schedule of the rates. The figures are given on a basis of 10 hour use:

PRESENT RATES FOR POWER.

2,200 volt alternating current delivered on the premises of customer.

The unit is the kilowatt-hour equivalent to 1 1-3 horse power hour.

Service charge for maximum power called for per month, $1 per unit or kilowatt. Equals $0.75 per horse power.

Additional charge by meter:

For 1,000 units or less per month, $0.02 per unit.
For excess over 1,000 up to 2,000 units, $0.015 per unit.
For excess over 2,000 up to 3,000 units, $0.012 per unit.
For excess over 3,000 up to 5,000 units, $0.01 per unit.
For excess over 5,000 up to 10,000 units, $0.008 per unit.
For excess over 10,000 up to 20,000 units, $0.0075 per unit.
For excess over 20,000 up to 40,000 units, $0.007 per unit.
For excess over 40,000 up to 80,000 units, $0.0066 per unit.
For excess over 80,000 units, $0.0061 per unit.

Example—An 80-horse-power motor running ten hours per day, taking 80 horse power at times as a maximum but averaging throughout the day about 60 horse power, would in 25 days per month consume current as follows: 60 x 10 x 25—15,000 horse-power hours, or reduced to units, 15,000 x 746-1,000—11,200 units.

The charge per month for this by the above table would be made up as follows:

Charge for service demand of 80 horse power, at $0.75	$60
Charge for power, 10,000 units, at $0.008	80
1,200 units, excess over 10,000 at $0.0075	9
Total charge per month	$149

As usually calculated by the consumer, dividing the total operating expense by rated horse power this charge is equivalent to $22.35 per horse power per annum.

*From the Buffalo *Times*, Dec. 11, 1898.

ADEQUATE FIRE PROTECTION FOR HIGH BUILDINGS.

The following article by Mr. Jean A. Wetmore, of Brooklyn, is rather unique in its way, but as it contains several suggestions worthy of note we give it space:

A fire lately occurred on Broadway involving an old-style low building and a modern fireproof sky-scraper. The Fire Department sent rattling along its antiquated paraphernalia, but on account of a high wind it was unable to control the fire in the low building, and because some inspectors were delinquent in their duties in not having the sky-scraper provided with fireproof window shutters, the latter caught and burned out the interior of its upper stories. The fire chief did the best he could with his liliputian apparatus. His little steam squirt guns on wheels puffed and snorted; his Siamese pipe-stem of a perambulating water tower could not be lengthened seventeen stories high, and so he called more funny little squirters and towers to his aid. But all the chief's horses and all the chief's men could not effectually squirt higher than nine stories. The chief saw the ridiculousness of his primitive efforts, for he is quoted as saying: "Let her burn, boys!" An extended conflagration might have ensued as far as the department was concerned had not the fireproof structure stood like a mighty bulwark and fire-wall to protect what was beyond.

Old-method "authorities" now tell us a law should be passed prohibiting buildings from being over a certain limited height in New York—all because the Fire Department's apparatus has not kept step with the changed modern building construction. . . .

All experienced traveling men know that a fast express train is safer than traveling on an accommodation or a freight train, and for much the same reason a sky-scraper is safer on account of the great skill and the best of material used in construction.

Whoever heard of the necessity of shoring up one of these buildings to keep it from tumbling down like the low, flat Rothschild building in Brooklyn.

Instead of laws limiting the height of buildings, called for by the New York and Philadelphia fire chiefs, we should require laws compelling the building of nothing but sky-scrapers along the blocks facing Broadway, in the place of the low buildings that are the true sources of conflagration.

Whoever heard of a serious fire originating in a sky-scraper?

Two parallel blocks of rows of sky-scrapers from the Battery to the Harlem River would prove an efficient fire-wall, extending along the backbone of Manhattan Island, to prevent an extended conflagration in a high wind, such as devastated Chicago before they were built in that city.

The more twenty-five and forty-story buildings the better; blow up the old rathole firetraps that disgrace our main thoroughfare, and allow us to become a representative modern city. . . .

The next problem to be solved is to make each sky-scraper its own stationary water tower for its individual purposes and also to drown out fires in surrounding buildings, even those across the street, and to water-soak any insignificant tinderbox structure that may be on fire below.

Then construct permanent stationary means to conduct plenty of water to each building, independent of the present over-taxed water system, and then provide means to get the water to the place with sufficient force.

To Western people the solution of these problems would be simple, easy and quick of practical solution. But to the old fogy mossbacks and time-servers in charge of our Eastern municipal departments, I doubt the possibility of the change unless we place the ideas on their heads and drive them clear through their cobwebby intellects with an axe; for their only originality consists in pulling down the buildings that are the pride of our city, in order to bring their roofs within the reach of their groveling intellects and their little puffy old steam squirt-guns.

The tall buildings of Western cities are provided with two or more stand-pipes reaching through to their roofs, to which two or more engines may be attached to each pipe when necessary, and the water pumped in solid unbroken streams, unaffected by prevailing winds, to any desired height; and in certain sections of those cities hose carts do not accompany an engine.

Other cities, like Detroit, have laid underground conduits from the river, independent of the usual water supply system, and a powerful fire-boat forces the water to the desired locality, and may be operated, if desired, in conjunction with the stationary stand-pipe, with or without the assistance of the usual fire engine.

Few of our buildings are provided with accessible stand-pipes, and we are unable to avail ourselves of the admirable river fire-boats for inland purposes. Our only auxiliary to the toy fire engines is a water tank on the roof that seldom, if ever, is full, or holds enough water, or gives adequate pressure where and when most needed; or a pumping apparatus in the basement, that is of little use on account of the time to get it in operation, or is of sufficient capacity. Both of these aids practice has shown are quite impracticable and unreliable.

There is probably no city in the world so admirably situated as New York for adequate fire service to meet modern requirements. For, situated on a long, narrow island, completely surrounded by water—and salt water at that—we have ideal conditions for an ideal installation. We may even banish hose carts, water towers and engines on wheels, and stop killing our citizens and the firemen (who are often strapped to their seats) in their mad career through our streets; sell our engine houses and take our firemen to fires in comfortable patrol wagons unaccompanied by the deadly juggernauts of dangerous fire apparatus.

This may be done by building underground parallel pipe lines at convenient distances apart from both the East and North rivers toward Broadway, with suitably situated and accessible valves to prevent undesired intercommunication.

These pipe lines could be connected to commodious stand-pipes in each building, and each floor provided with hose, and each fourth floor provided with pipes branching toward the exposed sides of each building from the stand-pipe, and provided with a dirigible nozzle toward the streets and areaways.

The river ends of each pipe would be provided with from three to five Siamese connections, to which the same number of fire-boats could be connected. It will then be possible to generate a water pressure that will blow the very skylights out of a fifty-story building; and if five fire-boats cannot do it, connect the stand-pipe with five other fire-boats from the other river.

A fire on any floor of a building thus protected may be fought from within by half a dozen streams of salt water, and from without with as many more from adjoining buildings, especially from across the street; and if any tiny steam fire engine wheezes its protests, it could by these means be washed into the bay.

If it be economical to build sky-scrapers, it will pay to protect them.

This system may find other very economical uses—such as flushing the sewers, sprinkling and sweeping the streets, melting snow and quelling riots.

The construction of a complete system of fire protection for Manhattan Island, substantially of the character described, would give us facilities far ahead of anything in the world. Then why wait for Oshkosh or Kalamazoo to set examples for us to follow like imitative monkeys, or adopt some little wrinkle from a jay town out West, when nature has given us advantages enabling us to be leaders and grandly systematic and progressive? As a city we should be admired and imitated for our progressiveness, instead of ridiculed for our conservative, servile imitations and antiquated, ineffective fire system.

The upper part of the island being much wider than the lower part, and the center being further from the river on each side, we might require an auxiliary system in case sixty-story buildings should be built in Harlem. When that time arrives, we will be duly prepared to master the situation by installing at convenient distances throughout the buildings, compact, efficient, direct-connected electric rotary pumps, taking their power from those unfailing sources of supply, the electric light and electric railway circuits, or both conjointly to insure positive results. This auxiliary system would help out our parallel pipe system, as outlined above, and compensate for the water friction in the additional length of pipe lines and the added heights of the stand-pipes, and in case of accidents of any nature these electric pumps could be connected with the present water system.

Our present water system is, from recent examples, too glaringly inadequate and out of date; and even though my suggestions are adopted finally by the city, it will take our municipal fathers and heads of departments so long to get their commissions agreeably adjusted that I would seriously advise the owners of our sky-scrapers to place no further reliance on the Fire Department or await the tardy action of the commissioners in the matter, but take immediate steps to install the electric pump system, as outlined, for emergency purposes, and thus be independent of municipal incapacity and procrastination. The chief points in its favor are its quickness, facility and cheapness of the installation and operation. It requires no skilled attendance other than the intelligence of turning a switch lever or a rheostat handle, and requires no addition to the present building employes. No steam boilers or additional machinery will be required. In fact, the system will be independent in all respects from existing apparatus, with practically no expense after installation, except interest on cost price and for electric current in case of fire, and possibly no appreciable extra piping, as the pumps could be connected directly to the existing water supply pipes.

This will be the most efficient makeshift possible until a dozen more million-dollar fires thoroughly accentuate the utter worthlessness of our fire system, and a long-suffering public get thoroughly aroused and demand radical improvements.

Low-Tension Accidents.

The safety rules of the Verband Deutscher Electrotechniker, which have already been accepted by most of the German Governments, have now also been accepted by the Prussian Government. The Minister, in his letter to Mr. Gisbert Kapp, the secretary of that society, asks to be informed what steps are intended to be taken with regard to voltages between 250 and 1,000, those up to 250 and over 1,000 alone having been dealt with in the above-mentioned regulations. The *Electrotechnische Zeitschrift* reproduces the communication made by the society to the Government on accidents caused in chemical and other factories. It is accentuated that the danger lies not in the pressure itself but in the strength of current produced by it. The current is in direct proportion to the pressure, and in inverse ratio to the resistance of the human body to the earth. From experiments made by Messrs. Siemens & Halske with their own workmen and those engaged in a sugar refinery, it appears that the average insulation resistance of the human body may be from 2,000 to 3,000 ohms under abnormal conditions, whereas it is as high as 100,000 ohms normally. This was ascertained in the following manner: Each workman was called from his work and made to grip one elec-

trode (representing the line), while the other electrode was placed on the ground. The range of the apparatus was from a few hundred ohms to 150,000. Other tests were made from hand to hand. The result was that out of 25 men in 17 cases the resistance was 150,000 ohms or more, in seven cases it varied from 50,000 to 150,000, and in the other test it varied from 4,000 to 17,000. All the workmen wore wooden shoes with leather toecaps. These results refer to normal trades. For workmen in certain factories the figures are very much lower. In one room in a sugar factory they ranged from 1,700 to 900 ohms. In the cooling-room, where the salt centrifugals are placed, it was from 2,400 to 1,000 ohms; in the boiling-room the resistance of the workmen was found to be from 3,000 to 1,200 ohms. Evidently much depended upon the dryness of the shoes. In the repairing shed, where the average resistance of the operators was 7,000 to 1,300 ohms, one man with new wooden slippers topped the list at over 150,000 ohms. In the sugar centrifugal room the limits were between 50,000 to 3,000 ohms—a wide range, indeed. Amongst nine men measured in the engine-room, six gave a resistance of over 50,000, two over 20,000, and one over 10,000 ohms. These figures are equally applicable to continuous as well as to alternating current.

LONDON NOTES.

[From our London Correspondent.]

Another Reason for American Competition.

At the present moment quite a number of electricity works in England are placed in a very awkward position by the failure of English electrical manufacturers to complete long-standing orders in anything like reasonable time. In some cases important municipal contracts are now over twelve months overdue, and if penalty clauses could be enforced there would be little profit remaining for the contractor. But that individual will shield himself by the strike clause when the very suggestion of penalty is even hinted at, and will blame everything on the protracted engineering strike of 1897–98. While we would not attempt to minimize the disastrous effects that that dispute had upon the electrical industry, we think it was by no means the only factor causing delay in completion of contracts. Some of the contracts are far longer overdue than the whole period over which the strike extended. It certainly looks very much as though English contractors are not in a position to turn out the machinery quickly enough to meet reasonable demands. Perhaps we may go so far as to accuse them of taking upon their books, for completion within so many months, orders which when booked there is not the least prospect of their being able to get ready within the stipulated period. The resultant inconvenience to the customer, whether municipality or company, needs no detailing, and the outcry against the importation of American and Continental machinery and apparatus is hardly warranted in the face of the present state of the matter. During the past few years borough electrical engineers, knowing there was little prospect of getting large plants made rapidly, have been looking a year or so ahead and placing their orders for extension plants long before they were likely to be required. But in several of these instances the increased demand for current and delay on the part of the maker of machinery have together led to disappointment, inconvenience and loss. At Manchester, for instance, the Corporation, acting under Mr. C. H. Wordingham's advice, ordered two large generating sets (for extensions), each of 2,500 HP. and capable of supplying together 100,000 8-CP. lamps. One of these was guaranteed to be running by *October, 1897*, and the other by September of this year. But neither of these is yet at work and the station is working with the same plant capacity as it had in March, 1897. On account of the increasing consumption, the matter became serious, and in November, 1897, the Corporation stopped making further connections for four months. At the end of that time, relying upon the faithful promises of contractors, other premises were connected to the mains with the result that to-day the whole of the plant is overloaded, and consumers are having to put up with a light at as low as 87 volts pressure for several hours daily. There is an order for ten boilers also considerably overdue, and in consequence the present steam plant is being forced. The Corporation has been placing the facts before consumers and asking for forbearance for a short time, and requesting them to dispense with as many lamps as possible from 4 P.M. to 6 P.M. At Edinburgh the situation is also deplorable, and the low pressure is giving rise to complaints on every hand. Generators and boilers are much overdue, hitches have occurred in the supply, and the management has been driven to temporary expedients. During the last few days the Corporation has had to do the same as the Manchester authority and ask for the co-operation of consumers by dispensing with certain lamps between 5 and 7 P.M. daily.

We think that there is an excellent opportunity for American houses, who are in a position to give quick delivery, to secure contracts, for if these delays are likely to continue English companies and municipalities will be more inclined to sink their likes and dislikes under the head of patriotism, and will buy in the most convenient market. The current friendly feeling for America and Americans would at any rate weigh with the more or less emotional municipal man.

Electric Cabs a Financial Failure.

Although from the point of view of convenience, etc., for street traffic the electrical cabs running in London give every satisfaction, their working is attended by anything but financial success. The London Electrical Cab Company during the twenty months ending July, 1898, shows a loss of over £6,000. When the service started, current was taken under agreement from one of the London electricity supply companies, but the cost was so excessive that now the cab company has put down a special generating plant and charges its accumulators itself, with a consequent reduction in cost. The maintenance of the accumulators and also the renewal of rubber tires are matters which have caused considerable anxiety and expense. We understand that experiments are being made with the Hatch accumulator in connection with the cab service.

Meeting of Educational Societies.

During Christmas week the American Chemical Society, the American Society of Naturalists, the Geological Society, the Society of Biblical Literature and the Mathematical Society will hold meetings under the auspices of the respective departments of Columbia University.

On Wednesday, the 28th, President Morris K. Jesup of the American Museum of Natural History will welcome the American Society of Naturalists at the American Museum in Eighty-first Street. Prof. Henry Fairfield Osborn will deliver a lecture, which will be followed by a reception at the home of Prof. Osborn.

The American Mathematical Society will hold its annual meeting on December 28 in Fayerweather Hall. The President, Prof. Simon Newcomb, of Washington, will preside. During the session the following papers will be read:

"Multiple Resonance," by Prof. M. I. Pupin, Columbia University; "On Transformation of Straight Lines Into Spheres," Prof. E. O. Lovett, Princeton University; "On a Certain Partial Differential Equation and Its Connection with Dirichlet's Principle," Dr. Waldemar Schulz, Cornell University; "On Development of the Perturbative Function in Terms of the Eccentric Anomalies," Dr. A. S. Chessin, formerly of Johns Hopkins University; "On Some Points of the Theory of Functions, Dr. Chessin; "On the Memoir or the Substitution Groups Whose Degree Is Less Than Nine," Dr. G A. Willard, Cornell University; "On Solution of Delaunay's Canonical Equations," Prof. Ormond Stone, University of Virginia; "A Generalization of Appel's Factorial Functions," Dr. E. J. Wilczynski, University of California.

New York Electrical Society.

The 192d meeting of the New York Electrical Society was held on Wednesday evening, December 14, at the College of the City of New York. The meeting was called to order about 8:10 with President Gano S. Dunn in the chair. Colonel Eugene Griffin of the First New York Volunteer Engineers spoke at some length on the problems and difficulties which led to the organization of the volunteer engineer corps in the late war, and concluded his remarks by recommending that an organization to be known as the United States torpedo militia be formed, to be composed of skilled electricians and engineers, which could be called upon by the Government in time of war.

The next speaker was Mr. F. W. Roller, who held the position of Chief Engineer on the Nashville during the conflict with Spain, which had afforded him an excellent opportunity of judging of the merits of electrically operated machinery on the vessels of the navy. Mr. Roller divided the electrical apparatus on a man-of-war into two classes, the first including enunciators, range-finders and various indicating and firing appliances; the second comprising incandescent lamps, motors and searchlights. Practically all the appliances of the first group, Mr. Roller said, were failures. On the other hand, the apparatus of the second class invariably proved satisfactory.

A paper by Mr. W. D. Weaver, entitled "Electricity in the War" (which will be found elsewhere in this issue), was then read by Mr. Roller in the absence of the author.

Captain Zalinski, well known as the inventor of the dynamite gun, made the closing address. He referred to the work of the Vesuvius, regretting that no opportunity had arisen during the war for testing the dynamite gun in a naval conflict.

The meeting was quite well attended, there being about 100 persons present.

Exports of Electrical Material from New York.

The following are the exports of electrical material from the port of New York for the week ending December 19:

Argentine Republic—289 packages, $17,650.
Brazil—1 case, $24.
Bremen—8 packages, $1,791.
British East Indies—5 cases, $183.
British West Indies—63 packages, $3,135.
British Possessions in Africa—16 cases, $275.
Cuba—29 packages, $641.
Ecuador—1 package, $12.
Hayti—2 cases, $207.
Hamburg—63 packages, $3,089.
London—31 packages, $4,504.
Odessa—4 cases, $110.
Porto Rico—26 cases, $1,213.
St. Petersburg—4 cases, $983.
Venezuela—1 case, $38.

Personal.

Mr. James R. Wiley, the Western manager of the Standard Underground Cable Company, is in New York on a Christmas visit to his Eastern friends. Mr. George R. Wiley, the Eastern manager of the same company, whose office is 18 Cortlandt street, reports business in first-class condition, and looks forward to a big increase in the coming year.

LEGAL NOTES.

The Thomson-Houston Electric Company and the General Electric Company have entered suits in the United States Court at Cincinnati against the Steel Motor Company and Johnson Electric Company, who are charged with making a style of electric commutator or switch on which the plaintiffs claim to have a patent.

The Court of Appeals of the District of Columbia held, in the recent case of the Metropolitan Railroad Company vs. Hammett, reported in the Washington *Law Reporter*, that an electric car has no exclusive or superior right of way at a point where its track intersects that of a horse-car line, but must be stopped to allow the horse car to pass when the latter arrives first at the point of intersection; that in such case the driver of the horse car is justified in supposing that the electric car is moving within the maximum rate of speed prescribed by law, and that his rights as that of the first arrival at the crossing will be respected by those in charge of the electric car, and that where under such circumstances a collision occurred between the horse car and the electric car by reason of the high rate of speed at which the latter was moving, and its failure to stop before reaching the point of intersection, it could not be said as a matter of law that the driver of the horse car was guilty of contributory negligence in attempting to cross the track of the electric car.

CANADIAN NOTES.

Dr. C. J. Edgar, manager of the Eastern Townships Light & Power Company, has concluded the purchase of the water power at Nengle's Dam, near Rock Forest, Quebec. The company intends to transmit electrical energy for power and lighting purposes to the city of Sherbrooke, Que.

The Lieut.-Governor-in-Council of the Province of Ontario, on the advice of the Attorney-General, has referred to the High Court of Justice for the Province certain questions to determine whether the non-completion by the Niagara Power Company of the water connections to the extent of 20,000 horse power, and 10,000 horse power actually ready for use, supply and transmission by the 1st of November, 1893, has not put an end to the agreement between the Park Commissioners and the company giving the latter exclusive use of the water power at Niagara Falls.

A syndicate of Toronto, Ont., capitalists is said to be now in Havana, Cuba, endeavoring to secure the franchise of the street railway system in that city. The gentlemen named are William MacKenzie, Frederick Nicholls, S. F. Madden and Z. Lash. The franchise includes an electric railway system for Havana and a steam railway to Matanzas. The latter railway is in existence, but for the city there is nothing at present save a line of cars drawn by mules. Sir William Van Horne, president of the Canadian Pacific Railroad, is also said to be interested.

The three county judges who have been hearing the appeal of the Bell Telephone Company from the assessment as fixed by the city of Toronto, Ont., have given judgment, knocking off over a half a million dollars. The assessment on land and buildings was not touched, but that of $377,992 on poles, wires and conduits was reduced to $32,750; the one of $177,174 on one switchboard was cut to $12,000 and on two others $50,733 to $3,900. This reduction is made because the company claims, and the judges decide, that the material should be assessed not as of a system in operation, but as separate parts, for what they would bring if they were taken away and sold.

Owing to the detrimental effect of the electric circuit in the city of Toronto, the Dominion Government found it necessary to move its Observatory to Agincourt, nine miles from Toronto. At present there is no electric railway at that point within seven miles, and little prospect of any being built for years to come. The new Observatory, which was finished last September, is divided into two parts. The circular cellar, nineteen feet in diameter and above ground, is an erection where the magnetic determinations will be made. Great care was taken in selecting materials for the building. Every stone used was tested for magnetic effect, and nothing but copper or zinc nails and fastenings have been used.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING.

Annapolis, Md.—The city council is considering a proposition to have the city purchase an electric light plant.

Bad Axe, Mich.—The local lighting company has offered to sell its plant to the village for $12,000, but the council considers the price too high.

Rogersville, Tenn.—A franchise has been granted to Webster & Spears to locate an electric plant at Spears' Mill, two miles from Rogersville. They will supply electricity for lighting this town.

Camden, N. J.—The lighting committee of the city council at a meeting on the 15th inst. decided to readvertise for proposals to light the city by electricity for periods of one, three or five years, the bids to be opened December 29.

Des Moines, Ia.—The General Electric Company has transferred to the Edison Company its electric light plant in this city, and the dam connected with it, for $116,000.

Eldora, Col.—A twenty-year franchise has been granted to the Eldora Mining, Milling & Power Company to put in water and electric lights for this town. Work will be commenced in the spring.

Ellicott City, Md.—The question of lighting the village of Savage by electric lights at county expense has been settled by the county commissioners deciding to authorize the improvement.

Enfield, Conn.—A petition is to be presented to the State Legislature for a charter to be granted for the formation of a light and power company in Enfield, to be known as the People's Light & Power Company, the object being to produce, generate, manufacture, buy, sell and distribute gas and electricity in the town of Enfield. The petition is signed by Thompson S. Grant, Edward Prickett and several other influential citizens of Enfield.

Grand, Rapids, Mich.—The lamp test authorized by the board of works was made on the 9th inst., but the board has disregarded the report of the committee and definitely settled the question by adopting the Adams-Bagnall lamp, although it was not entered in the tests, the company holding that in the contract with the Chase Construction Company for the installation of the new municipal plant the Adams-Bagnall lamp was one of the two distinctly specified. The decision of the board was probably a prudential one, to avoid a lawsuit.

Huntingdon, Tenn.—This town will soon vote on the question of putting in an electric light plant.

Jeffersonville, Ky.—Frank Patterson, who represents a Chicago firm, is trying to secure a lighting contract from the council. He is reported as offering to furnish 100 arc lights at the rate of $60 a year each, and any additional number at $58 each. The city under the present contract is paying $90 each for forty-five arc lights and $85 for all lights in excess of that number. There are doubts about the validity of this contract, and the council has asked the city attorney for an opinion on the question.

Johnstown, N. Y.—The special committee to consider and report matters of city improvement which should be submitted to the taxpayers at a special election has reported a list of propositions, among which is the equipment of the municipal electric lighting plant. The report was accepted by the council.

Medina, N. Y.—The board of aldermen, acting with the citizens' committee, have made a contract with A. L. Swett for lighting the village for five years. The agreement provides that all public buildings, such as the school houses, police station, etc., should be lighted gratis, and the street lights should be lighted on the moonlight schedule until 1 o'clock for $60 per light, but gives the village the option of at any time changing this system to an every night schedule for $70 a lamp, or all night lights on the 1 o'clock schedule at $80, or the all night every night system at $90.

Milwaukee, Wis.—The committee on public buildings of the county board is considering the advisability of installing a heat, light and power plant in the courthouse. It is thought that a plant can be put in at a cost of about $10,000. Nothing will be done about the matter until after January 1.

Milledgeville, Ga.—The council has given up the idea of purchasing an electric light plant for the city for the present, and has made a new contract with the Milledgeville company for $500 less than the last contract.

Moro, Ore.—H. V. Yates, proprietor of the water plant at Heppner, is investigating the feasibility of establishing an electric light and power plant on the Deschutes river to supply Moro and perhaps Grass Valley and Wasco with light and power.

Palouse, Wash.—Charles McKenzie and J. W. Higgins of Colfax have been negotiating with the city council and business men of Palouse for the establishment of an electric light system in the city and think it likely that a plant will be put in. Mr. McKenzie is one of the owners of the electric light plant in Colfax.

Pelican Rapids, Minn.—This village at a special election on the 7th inst. voted bonds to the extent of $14,000 for the purpose of constructing a system of waterworks, an electric light plant, etc.

Santiago, Cuba.—Gen. Wood has arranged with the American Electric Lighting Company to illuminate the streets of Santiago with incandescent lights at every corner and arc lights in the main plaza.

St. Thomas, Can.—This city will vote in January on a by-law to raise $33,000 for the establishment of an electric lighting plant under municipal control, the plant to be of sufficient capacity for 100 arc lights.

Tampa, Fla.—The big dam of the Consumers' Electric Light & Street Railway Company, nine miles from this city on the Hillsborough river, was blown up on the night of the 13th inst. It seems that countrymen opposed to the company exploded dynamite, completely destroying a plant which cost more than $100,000. Electricity for lighting and street railway power for Tampa is derived by the company from the river, the power house being near the destroyed dam.

Wellington, Kan.—At a meeting of the Commercial Club held recently it was decided to submit a proposition to vote $100,000 of bonds to bear 4 per cent. interest for the purpose of enabling Wellington to purchase or construct a waterworks system and electric plant. The committee appointed to take charge of the matter consists of John T. Stewart, A. Graff and W. A. Renn.

Wilkes-Barre, Pa.—The project for a new electric light plant in this city is said to be meeting with much favor. The projectors expect to raise $50,000 for the purpose, and have already obtained several subscribers for the stock.

Zanesville, O.—The commission appointed some months ago to investigate the feasibility of erecting a municipal electric light plant have made a report to the council recommending that the city continue under the contract system. The commissioners, after investigation, were of the opinion that the saving of a municipal plant, if there should be any, would be too small to warrant the expense and trouble of maintaining the same.

STREET RAILWAYS.

Ansonia, Conn.—A corporation has been formed in this city to be known as the Seymour Electric Railway Company, which will petition the next session of the General Assembly for the privilege of building and operating a trolley road between this city and Seymour. The incorporators are prominent business men of Seymour and Ansonia.

Boston, Mass.—The Boston, Quincy & Fall River Bicycle Railway Company, E. Moody Boynton president, has filed an application to the Legislature to have the time limit for building its railway extended. Under the act of 1897 at least twenty miles must be constructed by June 11, 1899. Mr. Boynton believes that the road will be built in time, but wants to be on the safe side.

Elmira, N. Y.—Surveyors are now at work on the Elmira-Watkins electric railroad, and it is confidently expected that the road will be constructed and ready for operation by the 1st of May. It will be necessary to construct seventeen and one-fourth miles of track to complete the road.

Hartford, Conn.—F. W. Siebert, Edward W. Shedd and C. Siebert will apply to the incoming Legislature for a charter to build an electric street railroad in Cromwell.—An application will be made to the General Assembly by the Hartford & Springfield Railway Company and others for the incorporation of a company whose purpose it shall be to construct and operate a street railway in the towns of Hartford, Wethersfield, Rocky Hill, Cromwell and Middletown for the purpose of carrying passengers and freight.

Libertyville, Ill.—The village board has granted a fifty-year franchise to the Chicago & Fox Lake Electric Railway to construct a trolley line through this place. The company contemplates the construction of a cross-country electric line from Lake Michigan to Fox Lake next spring.

Middletown, Conn.—Thomas M. Waller, S. Harrison Wagner, James K. Guy, I. A. Kelsey, E. W. Goss, James W. Dewell and W. B. Furgeson have filed notice that an application will be made by them to the General Assembly of the State at the approaching session for the incorporation of a street railway to run from Middletown to Meriden.

New London, Conn.—Samuel Eddy and J. H. Roraback of Canaan will apply to the next General Assembly for right to incorporate a street railway company to operate from Twin Lakes to Canaan and thence northerly to the Massachusetts line, where connection will be made with a line running to one or more of the popular resorts about Great Barrington.

Owosso, Mich.—The Long Lake, Durand & Corunna Electric Street Railway Company will begin work in Durand before the last of December and will work toward Owosso. The road will be completed this winter as far as Corunna, where it will join with the Owosso & Corunna Traction Company's road. Early in the spring work will be pushed to Long Lake, and possibly as far as Pontiac.

Pine Bluff, Ark.—After many promises and as many disappointments, an electric car line and lighting plant are assured for this city, the necessary amount of stock having been fully subscribed through the efforts of Col. S. W. Fordyce, late president of the St. Louis Southwestern Railroad, Mayor D. C. Bell and Attorney

Henry C. Wood of Chicago. Work on the plant will begin at once.

Pittsburg, Pa.—The bursting of a 15-foot flywheel at the Birmingham Traction Company's power plant, South Thirtieth and Carson streets, on the night of the 11th inst, wrecked a 300 horse-power engine, damaging the building to a considerable extent. The accident created a great deal of excitement in the neighborhood, the noise being heard for several squares away. A crowd was on the spot in a few minutes. When an investigation was made it was discovered nobody had been hurt. Engineer Sy Kerr had walked around the engine but two minutes before, and had gone out into the main power building, where he was when the wheel burst.

Reedsburg, Wis.—A thirty-year franchise has been granted to a Sauk County corporation for an electric railway from Devil's Lake to Baraboo, Minor Lake, Delton and Kilbourn, making a direct connection between the Northwestern and Milwaukee railroads.

Saginaw, Mich.—An electric railway from Saginaw to Detroit is said to be contemplated by a number of Detroit and Eastern capitalists. Work will begin in the spring.—The Saginaw & Frankenmuth Railway Company is securing right of way and construction will soon begin.

Trenton, N. J.—Ex-Senator George O. Vanderbilt and Mr. Sadlier, representing a number of capitalists, are said to be acquiring right-of-way over private lands for a trolley line between Trenton and Princeton via Lawrenceville. The line will be chartered under the general railroad law, enabling it to carry freight and express as well as passengers.

Troy, N.Y.—In connection with the rumor that Troy and Hoosick Falls are to be connected by an electric line it is stated that North Adams and Albany capitalists are the promoters of the scheme, and that the enterprise is not connected with the Hoosick Valley Electric Railway. It is stated that parties interested in the electric railway between North Adams and Williamstown are also interested in the proposed new road, and that the plan is to meet with that road at Williamstown, thus giving a direct line from North Adams to Troy. The proposed route will be through a country greatly in need of a railroad of some kind.

Washington, D. C.—The District Commissioners have approved the request of the Columbia Railway Company for permission to change the motive power of the road from cable to electricity. The Columbia Railway is the only remaining street car line in Washington depending upon the cable as a motive power.

Winsted, Conn.—A number of capitalists headed by W. H. Terry and H. L. Sanbom of Canton will make application to the General Assembly for a charter to build a trolley road through the towns of Avon, Canton, New Hartford, Barkhamstead, Winchester and Colebrook to the Massachusetts line. The proposed road will nearly parallel the Philadelphia, Reading & New England Railroad between Winsted and Hartford, a distance of 30 miles.

POWER AND TRANSMISSION PLANTS.

Black Hawk, Col.—It is the intention of the Bringham Mining & Milling Company to erect a 50-ton plant for low grade ores near this town. The method of treatment will be first by roasting, second by chlorination, third by leaching, and fourth, precipitation by electrolysis, the values forming a chloride to be afterwards separated by electrical appliances. The cost of the plant will be about $20,000 and the Gates Company of Chicago is reported to have received the contract.

Lake City, Col.—The Hinsdale Electric Light & Power Company of this city has purchased a tract of land near Argenta Falls from A. E. Reynolds, and will utilize the water to supply light and power to the city and mines in this vicinity.

Richmond, Va.—The company which is to develop the water power of the James River, the Virginia Electrical Railway & Development Company, has applied to the street committee for permission to acquire the privileges granted by ordinance to the Virginia Electric Company of Baltimore and to utilize the $5,000 in bonds put up by the Southern Electric Company, the franchise of which is to be allowed to die; both of these companies have by assignment of rights or otherwise been merged in the Virginia Electrical Railway & Development Company. Under the new organization, the company agrees within fifteen months from the approval of the ordinance, to begin in a manner satisfactory to the city engineer, to construct and erect such hydraulic work in and near James river as may be necessary to furnish water power to produce not less than two thousand horse power of electricity for the furnishing of electric power and light. The officers of the Virginia Railway & Development Company are: President, F. C. Todd; directors: F. C. Todd, L. M. Williams, R. L. Williams, F. L. Todd, F. P. Christian, of Lynchburg, Va., John L. Williams and W. I. Cross of Richmond.

San Diego, Cal.—One of the most famous of the big irrigation dams of the world is that at Sweetwater, which has stood for ten years. It is proposed to get some 2,000 horse power at this dam and transmit it to this city, twenty miles. U. S. Grant, Jr., and Jesse Grant, sons of General Grant, are at the head of a company which has the plan in view. Electrical engineers have reported that nowhere can water power be developed and transmitted cheaper than in San Diego County. There are other great water powers in San Diego mountains and canons, and it is reported that the Atchison, Topeka & Santa Fe Railroad Company is having its engineers search there for a new power for its locomotives on the Southern California division.—A project to harness the waters of the stream in Sanchez Canon, among the Sierras, back of Stockton, in the upper part of the San Joaquin Valley, is going ahead. Engineers are at work ascertaining what power may be developed there and the best means of conveying it from the mountain streams and waterfalls to Stockton and possibly to San Francisco. Enough work has been done to show that at least 4,000 horse power may be sent in an electric current from the transformers over several copper wires through the San Joaquin Valley.

MANUFACTURING, ETC.

Columbus, O.—The Bullock Electric Manufacturing Company of Cincinnati has filed notice of change of location to Norwood, a suburb of Cincinnati.

Durban, Natal.—The town council is about to appoint a commission of two engineers to investigate and report upon the electric street railway systems of America and Europe, in order that they may intelligently decide upon the best system to be installed in Durban.

New York.—The contract for the equipment of the new underground trolley system of the Third Avenue Railroad Company has been awarded to the Westinghouse Electric & Manufacturing Company. The contract involves the expenditure of about $5,000,000. By the terms of the contract the Westinghouse Company will construct the steam engines, boilers and entire steam plant necessary to equip the power house, besides the car equipment, electric generators and all the electrical apparatus required. The plans call for a power house on the company's property at 216th street with a steam and electrical capacity of 64,000 horse power.

Washington, D. C.—Proposals will be received at the Bureau of Navigation, Navy Department, until 12 o'clock noon on Thursday, the 12th day of January next, for the construction of a power house at the Naval Academy, Annapolis, Md. All requisite information may be obtained on application to the Chief of the Bureau of Navigation, Navy Department; the Superintendent of the Naval Academy, Annapolis, Md., or Mr. Ernest Flagg, architect, 35 Wall street, New York.

West Superior, Wis.—The contract for the electrical plant for the Great Northern's 3,000,000 bushel steel tank elevator has been let and construction of the elevator will begin as soon as possible in the spring.

COMPANY MATTERS.

Elbridge, N. Y.—The Elbridge Electrical Apparatus Company has bought the stock, fixtures and good will of the Elbridge Electrical Manufacturing Company, and the business will be conducted hereafter under the name of the Elbridge Electrical Manufacturing Company.

PERSONAL AND MISCELLANEA.

Dwight H. Gay, an electrician, employed at a theater in Portland, Me., became demented recently and was placed under restraint. On the night of the 8th inst, he managed to elude the vigilance of the attendants in the hospital where he was confined and committed suicide by hanging. Mr. Gay was 37 years of age and a native of Orange, N. J.

Capt. P. Pizzini of Richmond, Va., who for several years has been acting as Assistant General Manager of the Richmond Railway & Electric Company, was in New York last week. It is understood that the object of his visit was to tender his resignation to the controlling stockholders of the road.

The Chester, Pa., "Times" states that Samuel Haigh, superintendent of the Citizens' Electric Light & Power Company of Clifton Heights, proved himself a mechanic equal to an emergency when a recent storm blew down the two smoke stacks at the power-house, thus shutting off the draught, and coming within an ace of leaving the adjacent territory in darkness, and also of shutting off the power from the trolley cars on the Delaware County & Philadelphia line. Mr. Haigh at once improvised a forced draught, and so kept the currents going all night. Around Clifton he is now "the lion of the hour," and his prompt and effective action having come to the ears of the company, he is also receiving commendation from that source.

At Cincinnati a few days ago, as we learn from the "Enquirer," an attempt was made to remove a portion of a burglar proof steel vault in the Lafayette Bank by burning it out with electricity. The experiment was partially successful, for when the electric arc was applied to the plates the steel melted before it like butter, but the men who undertook the job will hesitate before undertaking a similar one. They were Manager Luke Lilley and George Minch, of the Devere Electric Company. After assuring themselves that electricity would do the work, they left the bank building with the intention of going to the Devere Company's office, but before they had taken a dozen steps they were both seized with pains in their eyes which were so excruciating that they could hardly desist from making some sort of an outcry. They were quietly hurried to their homes where they are now kept in dark rooms. As near as can be ascertained the trouble is due to the fact that the optic nerve was affected by the brilliant glare when the carbon came in contact with the steel sheet of the vault. Every time the tool touched the steel a light was shown even brighter than the reflections from an arc lamp. This brilliant glare, it is thought, partially deadened the optic nerve and in this way the sufferings of the two men were brought about. Both wore heavy blue glasses, but these seemed to have lost their effectiveness so far as the burning of the steel was concerned. It will take several days to determine how seriously the two men's eyes have been injured, and, of course, the work of burning away the vault has been abandoned until they recover. It is likely that some optician will be able to manufacture a glass that will defy the piercing and brilliant rays, and in this event the work will be carried on.

RECENT COMPANY ELECTIONS.

Allentown & Kutztown Traction Company, Allentown, Pa.—President, H. J. Schmick of Hamburg; secretary, G. H. Gerber of Pottsville; treasurer, C. A. Dorney of Allentown; directors: the officers and Howard E. Ahrens of Reading, Asa R. Beers of Mauch Chunk, and W. D. Mohn of Mohnsville.

Bennington & Hoosick Valley Electric Railway Company, Bennington, Vt.—Directors: George E. Greene, Galen C. Moss, Edward L. Bates, Irving E. Gibson, Joseph Buckley, Watson M. Holmes, Levi E. Worden, William C. Geer and F. S. Donnell.

Catoctin & Myersville Electric Railway Company, Myersville, Md.—Directors: Cyrus F. Flook, D. C. Winebrener, George William Smith, Joseph W. Gaver, William M. Bittle, John C. Leatherman, George Dallas Gaver, Charles Johnson, George T. Thomas and John T. Hildebrand.

Consolidated Street Railway Company, Worcester, Mass.—President, Francis H. Dewey; vice-president, A. G. Bullock; treasurer, A. H. Stone; directors: the officers and Thomas C. Barr of Newark, N. J., and E. F. Moore of Philadelphia.

Lancaster Gas Light & Fuel Company and Edison Electric Illuminating Company, Lancaster, Pa.—President, John I. Hartman; secretary, J. H. Baumgardner; treasurer, John C. Carter; directors: the officers and J. D. Skiles, J. Fred Sener, H. M. North, N. Milton Woods, W. U. Hensel, D. McMullen, J. Gust Zook, H. C. Demuth, Dr. George R. Rohrer, H. S. Williamson and P. B. Shaw.

Washington Illuminating Company, Washington, Ia.—President, W. A. Cook; vice-president, J. Klein; secretary and treasurer, Frank Stewart; directors: W. A. Cook, J. Klein, William Smouse and C. W. Stephens.

COMMERCIAL PARAGRAPHS.

The Electric Storage Battery Company, Drexel Building, Philadelphia, makers of the well-known Chloride Accumulator, have recently gotten out an interesting pamphlet in which among other things they say: "Few things have hindered the development of the storage battery so much as patent litigation, which has operated not only to arrest improvements in accumulator construction but to limit the sphere of usefulness of accumulator cells by impressing intending purchasers with their liability to law-suit. The policy of the Electric Storage Battery Company has been from the very first to protect the users of storage batteries in their rights. To carry out this policy the Electric Storage Battery Company some years ago acquired all the basic patents and patent rights underlying the manufacture of storage batteries, whereby it secured to itself the sole right to supply in the United States all the important types of storage batteries developed to that time. Since then it has secured control of the patents and patent rights for new and valuable types. As in the past, so in the future, absolute protection will be guaranteed to the users of every form of storage cell manufactured by this company. The acquisition by the Electric Storage Battery Company of the patents and patent rights for the manufacture of all the modern types of storage batteries enables it to furnish cells that are adapted for special work."

The American Pegamoid Company, 346 Broadway, New York, is handling a high grade of paint for various uses which from all accounts appears to be giving great satisfaction. The following communication received by the company speaks for itself:

The National Automatic Machine Co.,
60 and 62 Murray St.,
New York, June 25, 1898.

The American Pegamoid Co., New York Life Building, 346 Broadway, City.

Gentlemen: It affords me much pleasure to report that the use of your "Pegamoid Aluminum Paint" has been most satisfactory. We have tried all sorts of compositions, bronzes, paints, varnishes, etc., but owing to the exposed positions of our machines we have experienced great difficulty in keeping them in good appearance. We have painted a large number of our machines with your Aluminum Preparation, and after several months' trial we are convinced that it will answer all requirements. Yours very truly, L. W. BALDWIN, Treas.

The Electric Appliance Company, Chicago, have taken the general Western agency of the well-known Crescent Tin Shade. This shade has been designed with a view to displacing the ordinary flat tin shade, and it is being manufactured in such large quantities that it can be sold for even a less price than the flat shade. It is curved in shape to concentrate the light as much as possible and has its bright surface corrugated to give a good distribution. It should certainly find a large field where the demand is for a durable and inexpensive shade or reflector.

INCORPORATIONS.

The Pine Bluff Electric Light & Street Railway Company, Pine Bluff, Ark. Capital stock, $300,000. Incorporators: Thomas L. Chadbourne, Jr., and Henry C. Wood of Chicago; H. H. Hunn, Sebastian Geisreiter, Peter P. Byrd, Jeff Hicks and Sam Taylor of Pine Bluff.

The Swedesboro Light, Heat & Power Company, Swedesboro, Pa. Capital stock, $25,000. Incorporators: Charles D. Lippincott, Henry M. Mitchell, Thomas B. Turner, John C. Rulon, Benjamin F. Lawrence and James J. Davidson, all of Swedesboro.

The W. E. Donley Electric Light & Power Company, Big Rapids, Mich.—to supply electricity for light, heat and power. Authorized capital, $10,000, all of which has been subscribed. Incorporators: W. E. Donley, J. S. Donley, D. M. Martindale, Chicago, Ill.; J. W. Morton, W. I. Trott, Big Rapids.

The Bloomfield & Orchard Lake Railway Company, Birmingham, Mich.—to construct and operate a street railway. Authorized capital, $25,000, all subscribed; paid in, $5,250. Incorporators: George E. Daines, Frank Hagerman, Almeron Whitehead, M. F. Lillis, Pontiac; George T. Hendrie, Detroit.

The Tuolumne County Water & Electric Power Co., Columbia, Cal.—to furnish water and electric power and light. Authorized capital, $550,000; subscribed, $143,000. Incorporators: J. W. Ellis, William Mansfield, Thomas Conlin, J. B. Pownall, Columbia; M. B. Harrimann, Shaws Flat; George Wight, Springfield, and George W. Hale, Sonora.

The Bradford Electric Light Company, Bradford, Ill. Capital stock, $10,000. Incorporators: Robert Thompson, Daniel J. Phoenix, Edmund P. Deyo and John P. Code.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DECEMBER 13, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

615,936. Trolley-Replacer for Electric Railways. Lucian A. Cowles, Randolph, Mass. Filed Feb. 7, 1898.
616,031. Trolley-Wheel Replacer. George E. Mittinger, Jr., Cleveland, O., assignor of three-fourths to Frederick J. Schweitzer, same place. Filed Sept. 2, 1898.
615,977. Car-Fender. Millard F. Field, Boston, Mass. Filed March 4, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

615,686. Electric Lamp. Walter S. Doe, Jersey City, N. J., assignor of one-half to John H. Weastell, same place. Filed Aug. 12, 1897. Renewed April 29, 1898.
615,904. Electric-Lighting Apparatus for Railway-Cars. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place. Filed July 7, 1898.
615,905. Electric-Lighting Apparatus for Railway-Cars. Willard F. Richards, Buffalo, N. Y., assignor to Charles M. Gould, same place. Filed July 9, 1898.
615,927. Electric-Arc Headlight. William G. Wagenhals, Dayton, O., assignor to the United States Headlight Company, Utica, N. Y. Filed Nov. 18, 1897.

ELECTRICAL MACHINERY AND APPARATUS.

615,673. Method of and Apparatus for Electrically Transmitting Power. Charles S. Bradley, Avon, N. Y. Filed July 14, 1897.
615,731. Dynamo-Electric Machine. William M. Mordey, Loughborough, England. Filed Feb. 15, 1897.
615,732. Dynamo-Electric Machine. William M. Mordey, Loughborough, England. Original application filed Feb. 15, 1897. Divided and this application filed Dec. 30, 1897.
615,952. Alternating-Current Generator. Charles S. Bradley, Avon, N. Y. Filed July 14, 1897.
615,953. Controlling Alternating-Current Motors. Charles S. Bradley, Avon, N. Y. Filed July 14, 1897.
615,954. Changing Period and Phase of Alternating Currents. Charles S. Bradley, Avon, N. Y., assignor to the General Electric Company, of New York. Filed June 22, 1896. Renewed Nov. 17, 1898.
616,035. Electric Motor. Julius L. Thoma, Kansas City, Mo., assignor of seventeen-twentieths to Agnus M. L. Miller, Crescent P. Brod, Louise V. Panhoff and John Potzner, same place. Filed June 20, 1898.
616,063. Ball-Bearing for Electric Motors. John Murphy, Torrington, Conn., assignor of two-thirds to David F. Halstead, New York City, and William M. Keepers, Newark, N. J. Filed March 15, 1898.

TELEPHONE AND TELEGRAPH APPARATUS.

616,016. Telephone-Switchboard. Thomas F. Ahern, Detroit, Mich., assignor to the Detroit Switchboard & Telephone Construction Company, same place. Filed May 27, 1897.

MISCELLANEOUS.

615,691. Method of Manufacturing Electrical Cables. Sebastian Z de Ferranti, Hollinwood, England. Filed Dec. 28, 1897.
615,693. Hysteresis-Meter. James L. W. Gill, Montreal, Canada. Filed March 25, 1898.
615,699. Electroplating Apparatus. John E. Hartley and Herbert E. Hartley, Birmingham, England. Filed Dec. 28, 1897.
615,752. Railway-Crossing Signal. John D. Taylor, Chillicothe, O. Filed Jan. 12, 1898.
615,814. Electric Firing Device for Ordnance. Arthur T. Dawson and George T. Buckham, London, England, assignors to the Vickers, Sons & Maxim, Limited, Sheffield, England. Filed May 16, 1898.
615,835. Vacuum Insulator for Electric Conductors. Joseph A. Poche, New Orleans, La. Filed Oct. 6, 1898.
616,019. Electrical Bedbug Exterminator. Frank M. Archer, New York City, assignor to Siegfried Silberberg, same place. Filed Feb. 7, 1898.

TELEPHONE AND TELEGRAPH.

A New Telephone Company in Boston.

The Massachusetts Telephone & Telegraph Company has been granted a franchise to lay conduits for its wires in all the streets of Boston. In reference to the new company, the Boston *News Bureau* says:

"The people at the head of the new company are mostly connected, or have been in the past, with the Lamson Store Service Co., prominent among whom are Messrs. Oakes Ames, A. C. Titcomb, John Shepard and General Counsel E. C. Gilman. Z. T. Holbrook, promoter and president of the company, was formerly Chicago manager of the Lamson Co. Minor officials of the Lamson Co. have been interested in independent telephone companies in the West for some time past.

"No money has been paid in as yet. Its capital of $10,000 is only nominal. It is proposed to capitalize it at between $2,000,000 and $3,000,000. The company proposes to use the 'automatic' system now in use in a small way in the States of New York, New Jersey and Pennsylvania. The chief financial advantage claimed for this system is its economy, it being entirely automatic in its exchange system, doing away with 'central' operators. The company anticipates no difficulty in securing subscribers. A canvass for subscribers will soon be made. Contracts will not become binding upon the subscriber until contracts for 10,000 telephones have been secured at a price not above $6 per month. The new company will be obliged to build conduits through the streets for its wires, as no existing conduits are available. It is claimed that the English and German rights for the use of the 'automatic' telephone have been sold for $1,000,000."

In three months the franchise of the Duluth Telephone Company expires, and the city authorities of Duluth have already asked for bids from those anxious to supply telephone service for the city. The bids are to be opened January 20, and are to specify what percentage of gross earnings the bidders will be willing to give the municipality in return for allowing them an exclusive franchise for a term of years. The Duluth Telephone Company has just completed the necessary equipment for operating a metallic circuit for telephones capable of transmitting over a long distance line direct and is putting them in residences at $36 per annum each for two 'phones on one line.

The Cumberland Valley Telephone Company, which operates at Chambersburg, Pa., and in that vicinity, has issued a circular warning its subscribers to beware of representations made by Bell company solicitors. The Cumberland Company officials say that all but five of the Bell subscribers have signed with them. It is predicted that the Bell company will give free service in order to drive its competitors out of business.

Sir Sandford Fleming, Chancellor of Queen's University, Canada, has written a letter to the Right Hon. Joseph Chamberlain, advocating the adoption of a system of State owned cables connecting every British possession and all Great Britain's naval coaling stations. Sir Sandford Fleming proposes three sections of cables, in the Pacific, Indian and Atlantic oceans, and estimates their cost at £6,000,000 ($30,000,000). The first step he suggests is a State owned Pacific cable.

Work has been completed on the extension of the Forman Telephone Company to Hankinson, N. D. The line will be pushed up to Wahpeton as soon as the weather will permit. At present the town of Forman, Lisbon, Sheldon, Enderlin, Puttsville, Milnor, Cogswell, Cayauga, Geneseo, Rutland, Perry, Forsby, Lidgerwood, Hankinson and Alicia are reached by the lines of the company.

At the annual meeting of the Fulton Valley Telephone Company at Fultonham, Schoharie county, N. Y., the reports submitted made so satisfactory a showing that a dividend of 10 per cent. was declared. The officers elected are: President, Dr. J. W. Canaday; secretary, J. H. Weckel; treasurer and manager, C. W. Vroman.

At the hearing before the Committee on Public Improvements at Boston, on the application of the Massachusetts Telephone & Telegraph Company for locations in Boston streets, the local Bell concern, the New England Telephone & Telegraph Company, appeared as a representant, being represented by Samuel L. Powers, who said: "This application is an ingenious one. It is not a modest order. It gives the new company five or six times as much in franchises as your board and its predecessors have given to our company and its predecessors in twenty years. If the new company can furnish the service of the New England Company for $6 a month, it ought to have its desire. This business is one in which the survival of the fittest prevails. To-day we are charging $156 a year for a long distance transmitter, with the right to the subscriber to talk to 19,000 persons. These gentlemen propose to furnish the same quality of service for $72. They must propose to get men to work for five cents a day. Last year the New England Company made on an average on each instrument it maintained but four cents a day, so that it could be seen that the company was doing a very close business. If the franchise is granted, we shall meet the new company, not by cutting prices, but by trying to keep up the quality of our service by employing American labor and paying American prices." Mr. Powers in concluding said the company did not wish to be understood as being remonstrants, but as a friendly rival, and it was ready either to go to the wall or to make a consolidation with the other company and wait for a new comer.

A despatch from Waco, Tex., states that the Long Distance Telephone & Telegraph Company of Texas has been incorporated, with $100,000 capital, to construct and maintain telephone and telegraph lines and exchanges in Texas. The incorporators are C. H. Brown and C. A. Meeker of Kansas City, Mo., and E. Rotan, W. W. Seeley, E. N. Stephenson, J. B. Earle and J. E Boynton of Waco.

At Trenton, N. J., on the 16th inst. the Boston and New York Telephone & Telegraph Company was incorporated with a capital stock of $1,000,000. The incorporators are Zephaniah S. Holbrook, of Cambridge; Oakes Ames, of Milton; Frederick A. Spear and Charles E. Adams, of Lowell, and J. Stewart Rusk, of Boston, Mass.

The board of directors of the Erie Telephone Company have voted to spend $1,000,000 for extensions next year, including additional long distance lines in the six States in which this company operates, and the connection of 10,000 new subscribers, which, it is believed, can be added in the year 1899 to the company's systems.

An effort is being made to establish a telephone company at Adairsville, Ga. It is desired to connect Adairsville with the surrounding towns and the big plantations and peach orchards which encircle the town. About fifty miles of wire will be used.

A bill has been introduced in the House of Representatives at Washington for Government control of telegraph and telephone lines, the same to be acquired by purchase, and appropriating $50,000,000 for extension of existing lines.

The telephone lines from Columbia, Ky., to Campbellville have been purchased from J. O. Russell by Reed & Milley of Columbia. The deal also includes a one-half interest in lines from Columbia to Gradyville.

A new telephone system on the co-operative plan has been installed at Flagstaff, Arizona, and the Sunset Company has withdrawn from the field. T. E. Pollock of the local bank is president of the new company.

The city council of Memphis will, it is believed, at an early meeting, pass a resolution requiring telephone and telegraph companies to place their wires underground in the business streets of the city.

The Western Union reports its estimated net revenue for the quarter ending December 31 as $1,450,000. For the same quarter last year the actual revenue was $1,553,415.

The local telephone companies of Mercer, Lawrence, Butler, Erie, Crawford and Beaver counties, Pa., and Trumbull county, O., have arranged to connect their lines.

New Companies Incorporated.

The Columbia Telephone Company, Columbia, Mo. Authorized capital, $5,000. Incorporators: James A. Hudson, Julia A. Hudson, Ethel A. Hudson, Macon; E. W. Stephens, A. W. McAllister, Columbia.

The Lafayette Telephone Company, Mexico, Mo.—to construct and operate telephone lines. Authorized capital, $12,500. Incorporators: D. P. Moore, M. B. Moore, E. D Graham, E. C. Kennan, P. M. Kennan.

The Thompson & Moab Telephone Company, Thompson Utah—to build and operate a telephone line between Thompson and Moab. Capital stock, $1,400. President, Arthur A. Taylor; vice-president, J. C. Taylor; treasurer, Robert James Thompson; secretary, Charles Wilson.

The Farmers & Merchants' Telephone Company, Warsaw, O.—to operate a telephone system between farms. Authorized capital, $5,000. Incorporators: J. P. Darling, S. C. Kissner, John Fischer, J. F. Rees, L. G. Rees, W. D. Kissner, T. L. Darling, C. L. Lousinger.

The Citizens' Telephone Company, Berea, O.—to operate a local telephone system. Authorized capital, $20,000. Incorporators: S. B. Rawson, J. A. Duke, F. W. Martin, T. M. Brush.

The Flemingsburg & Myers Station Telephone Company, Ewing, Ky.—to do a general telephone business. Capital stock, $600. Incorporators: I. B. Sherwood, W. R. Parnell, Robert Harper, I. N. Price, W. West.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Dec 19:						
Albany Ry. Co.	100	2,000,000	$1,750,000	1½ % Q., Aug. '98.	150½	151
Troy City Railway Co.	100	2,000,000	2,000,000	1 % Q., Aug., 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	..	..
Allentown Pa.—Dec 19:						
Allentown & Lehigh Val. Trac. Co.	....	4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Dec 19:						
Bridgeport Traction Co.	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Dec 19:						
Baltimore City Passenger Ry. Co.	25	6,000,000	2,500,000	5 % S., July 2, '98.	...	...
aBaltimore Consolidated Ry. Co.	25	10,000,000	9,177,000	3 % S., July 15, '98.	31¼	32
Central Ry. Co. of Baltimore City	50	300,000	300,000	6 % A. Dec., 1897.	...	..
Boston, Mass.—Dec 19:						
New England Street Ry.	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	18¼	18¾
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	10	12
North Shore Traction Co........pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	78	77
b West End Street Ry. Co......com.	50	10,000,000	9,085,000	3½ % S., Oct., '98.	89⅝	90
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	110	110½
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	81¼	..
Brooklyn N. Y.—Dec 19:						
Brooklyn City & Newtown Ry	100	2,000,000	1,928,400	2 % Feb. 1, 1898.	250	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	72¼	72⅜
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	239¼	240¼
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	250	275
Kings County Elevated	....	4,750,000	4,750,000	....	4½	5½
Kings County Traction Co.	100	4,500,000	4,500,000	1 % July 26, '97	48	..
Nassau Electric Railroad ....pfd.	......	6,000,000	6,000,000	....	90	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B. & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Dec 19:						
Buffalo & Niagara Falls Elec. Ry.	100	1,250,000	1,250,000	....	60	66
*Buffalo Railway Co.	100	6,000,000	5,370,500	1 % Q. Dec., '97.	76½	77
Columbus O.—Dec 19:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Aug., '98.	60	62½
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Dec 19:						
Charleston City Ry. Co.	50	100,000	100,000	3 % S., Jan., '98.	..	..
Enterprise City RR. Co.	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Dec 19:						
Chicago City Ry. Co.	100	12,000,000	12,000,000	3 % Q.	295	297
Chicago & South Side R. T. RR.	100	10,328,800	10,328,800	....	..	..
Lake Street Elevated RR.	100	10,000,000	10,000,000	....	13½	...
Metropolitan West Side Elev. Ry.	100	15,000,000	15,000,000	....	..	4
Met. West Side El. const. stk.	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR.	100	10,000,000	6,000,000	3 % Q., Oct., 98.	224	225
hNorth Chicago City RR.	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,608,200	....	..	..
iWest Chicago St. RR. Co.	100	20,000,000	13,189,000	1½ % Q., Nov. 98.	98	...
jChicago West Div. Ry.......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Dec 19:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	..
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	...	80¼
lCincinnati Street Ry. Co.	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118¾	119¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1½ % Q.,Jan., 98.	..	..
Cleveland, Ohio.—Dec 19:						
Akron, Bed. & Clev. Elec. Ry.	100	1,000,000	1,000,000	¾ % Jan., '98	40	42
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	58	..
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98.	80	82
Detroit, Mich.—Dec 19:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '98.	175	..
Rapid Railway Co.	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Dec 19:						
City Railway Co............ .com.	100	1,500,000	1,470,600	1½ % Q., Jan.1,'98.	108½	109
City Railway Co................pfd.	100	600,000	600,000	1½ % Q.,Jan. 1,'98	155	157
People's Street Railway	....	1,100,000		....	105	

*Unlisted. †Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.
b Leased to Boston Elevated Railroad Company.
c Owned by Brooklyn Rapid Transit Company.
d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.
e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.
f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR
g Owned by Atlantic Ave. RR. and leased to Nassau system.
h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $230,100 of stock owned by North Chicago Street Railroad Company.
i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.
j 30 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.
k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,300,-000 stock guaranteed by West Chicago Street Railroad Company, lessee.
l Cincinnati St. Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Dec 19:						
Hartford Street Ry. Co.	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	—
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	—
Holyoke Mass.—Dec 19:						
Holyoke Street Ry. Co.	100	400,000	400,000	8 % A., Jan., '98.	185	200
Hoboken, N. J.—Dec 19:						
North Hudson Co. (N. J.) Ry. Co.	25	1,250,000	1,000,000	8 %, 1892.	105	—
Indianapolis, Ind—Dec 19:						
**Citizens' Passenger Ry	....	5,000,000	5,000,000	....	25½	28
Lancaster, Pa.—Dec 19:						
Pennsylvania Traction Co.	100	10,000,000	9,900,000	....	..	—
Lancaster & Col. Electric Ry.	....	....	87,500	....	..	—
West End Street Railway	....	....	....	....	..	—
Louisville, Ky.—Dec 19:						
Louisville Ry...................com.	100	4,000,000	3,500,000	1½ %., Oct., '97.	40¾	42
Louisville Ry......................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	100	102
Minneapolis, Minn.—Dec 19:						
Twin City Rapid Transit........com.	100	17,000,000	15,010.000	....	28	31
Twin City Rapid Transit....7 % pfd.	....	3,000,000	1,714,200	1¾ %. Jan., '98.	101	103
Montreal, Canada.—Dec 19:						
Montreal Street Ry. Co.	50	4,000,000	4,000,000	3 % S., M. & N.	283	284
Toronto Street Ry. Co.	100	6,000.000	6,000,000	1¾ % S., J. & J.	105¾	106½
Memphis, Tenn.—Dec 19:						
Memphis Street Railway Co.	100	500,000	500,000	....	15	—
New Haven, Conn.—Dec 19:						
Fair Haven & Westville RR.	25	1,500,000	900,000	3 % S., Sept. '98.	30	...
New Haven Street Railway Co.	100	1,250,000	1,000,000	2½ % A., July '98.	60	80
New Haven & Centerville	100	700,000	300,000	....	..	—
Winchester Avenue RR.	25	1,000,000	600,000	....	45	..
New Orleans, La.—Dec 19:						
Canal & Claiborne RR. Co.	40	240.000	240,000	4 % S., Jan., '98.	152	200
New Orleans & Carrollton RR.	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	122	127
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	2	2½
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	8	11
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	18	21
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	..	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	25	27
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	54	58
New York—Dec 19:						
Central Crosstown RR.	100	000,000	600,000	2½ % Q.	255	280
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	170	..
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98.	165	165
dMetropolitan Street Ry. Co.	100	30,000,000	30,000,000	1½ % Q., Oct., 98.	192½	193
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¼ % A., July, '98.	33½	30
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	230	..
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2½ % Q.	180	189
hEighth Avenue RR.	100	1,000,000	1,000,000	....	348	355
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	380
jNinth Avenue RR..........guar.	100	800,000	800,000	....	165	180
kSixth Avenue RR...............guar	100	2,000,000	2,000,000	....	200	225
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	385	420
Second Avenue RR.	100	2,500,000	1,862,000	2 % Q., July, '98.	168	190
Third Avenue RR.	100	12,000,000	10,000,000	$2 p. sh. Aug. 98.	166	168
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	74½	75
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Dec 19:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	56½	57
Newark Passenger Ry.	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry.	100	504,000	504,000	11½ % A.	195	205
Pittsburg, Pa.—Dec 19:						
Allegheny Traction Co.	50	500,000	500,000	....	..	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '98.	21¾	22
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %. May, '97.	59	59½
pCentral Traction Co.	50	1,500,000	‖900,000	1½ % Nov. 7, '98.	..	...
qCitizens' Traction Co.	50	3,000,000	‡3,000,000	6 % A.	64	65
rDuquesne Traction Co.	50	3,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co.	50	2,500,000	1,900,000	3½ %, Nov. 7, '98.	..	..
Federal St. & Pleasant Valley Ry.	25	1,400,000	1,400,000	2½ %, Jan., '98.	26	26½
Pgh., Allegheny & Man. Trac. Co.	50	3,000,000	‖2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry.	25	3,000,000	3,000,000	½ %, Jan., '96.	..	28
Pittsburg & West End Ry.	50	1,500,000	1,800,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co.	50	300,000	900,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.
b Leased to New Orleans Traction Company at 3 % on stock.
c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.
d Operating the former Met. Trac. system, that corporation having become extinct.
e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.
f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.
g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %
h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $ 5,000 per annum
i Leased to Metropolitan Street Railway for 18 % on stock.
j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter
k Leased to Metropolitan Street Railway for $145,000 per annum.
l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.
m Controlled by Third Avenue Railroad by purchase.
n Dividends of 1½ % yearly guaranteed by Consolidated Traction Company.
o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co
p Leased to Consolidated Traction Company for 3 % per annum on par value o stock
q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.
r Leased to Consolidated Traction Company for 6 % on capital stock after October.
s Leased to Consolidated Traction Company for 7 % on capital stock after October.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Dec 19						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass—Dec 19						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Dec 19.						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Dec 19:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Dec 19:						
United Traction & Electric Co	100	8,000.000	8,000,000	¾ %, Jan. '98.	70	72
Philadelphia.—Dec 19:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14⅝	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	42	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	583,900	‖583,900	3 % S—July, '98.	68	..
*a*Fairmount Pk. & Had. Pass. Ry.	50	800,000	300,000	3 % Feb. 1, '98.	66	..
Union Traction Co............ $12½ pd	50	30,000,000	29,930,450	....	30⅝	30⅞
*c*Electric Traction Co	50	....	8,297,920	....		...
*d*Citizens' Passenger Ry	50	500,000	†192,500	$8 share Q.	330	..
*e*Frankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	105	..
*f*Lehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
*f*Lombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
*d*Second & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	475	...
*c*People's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '93.	...	..
*g*Germantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	135	138¼
*g*Green & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	135½	..
*h*People's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
*h*People's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
*i*Philadelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh., Oct. 98.	94¼	95
*j*Catherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
*j*Continental Pass. Ry.....guar..	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
*j*Philadelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	170	180
*j*Philadelphia & Gray's Fy. RR..	50	1,000,000	298,650	$3.50 share July '98	90	..
*j*Ridge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	295	300
*j*Philadelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
*j*17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
*j*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖835,000	$11 sh. A., July, '98	2,0	..
*j*Union Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	228	..
*j*West Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	235	250
Rochester, N. Y.—Dec 19:						
Rochester Railway Co	100	5,000,000	5,000,000	....	13	15
Reading, Pa.—Dec 19.						
*j*Reading Traction Co	..	1,000,000	1,000.000	Semi-an., Jan. & Jy	18	20
*k*City Passenger Ry	50	850,000	850,000	Jan., '98.	114	...
*l*East Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Dec 19:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct.,'98.	167	169
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	120	125
Cass Avenue & Fair Grounds	..	2,500.000	2,500.000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	4 %, Oct., '98.	..	..
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR	50	2,400,000	2,300,000	1½ % Oct., '98.	190	193
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry..........com.	50	500,000	500,000	....	62	61
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	130	131
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	53	59
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	125	150
San Francisco, Cal.—Dec.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	109	...
Geary Street Park & Ocean RR	100	1,000,000	875,000	$2.50 share, '96.	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	55½	56
Presidio & Ferries RR	100	1,000,000	550,000	....	8½	..
Scranton, Pa—Dec 19:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12½	15
m Scranton & Carbondale Trac. Co..	100	500,000	500,000	....	14	18
m Scranton & Pittston Traction Co..	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Dec 19:						
Springfield Consolidated Ry	100	750,000	750,000	....	----	..
Springfield O.—Dec 19:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	..
Springfield, Mass.—Dec 19:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	200	207½
Toronto Canada.—Dec 19						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	105¾	105⅛
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	283	281
Washington, D. C.—Dec 19:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	87⅛	87½
Columbia Ry. Co	50	400,000	400,000	6 % A.	65	75
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	17½	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	...	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	183½	184
Worcester, Mass.—Dec 19:						
*Worcester Traction Co.........com.	100	8,000,000	8,000,000	....	13	15
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	95	98
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Dec 19:						
Wilkesbarre & Wyoming Val. Trac	100	5,000,000	5,000,000	1%. Jan., '97.	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.

a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.

b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.

c Practically all shares owned by Union Traction Company.

d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co

e Leased to Electric Traction Company.

Controlled by Frankford & Southwark Passenger Railway.

g Leased to People's Passenger Railway at $5 per share.

h Majority of stock owned by People's Traction Company.

i Leased to Union Traction Company.

j Lease transferred to Union Traction Company.

jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 18[illegible]-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.

k Dividend of 10 % guaranteed by Reading Traction Company.

l Dividend of 6½ % guaranteed by Reading Traction Company.

m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Dec 19						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., Oct., '98.	276	277
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '98.	76	76¾
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	138	..
New York.—Dec 19:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	97	98½
Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	108	10
Commercial Cable Co	100	10,000.000	10,000,000	1¾ % Q.	185	190
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	75¼	76
Gold & Stock Telg. Co..guar. 6 %.	100	5,000,000	......	1½ % Q.	110	..
International Ocean Tel Co.guar 6%	100	8,000,000	......	1½ % Q.	108	..
Mexican Telephone Co	100	2,000,000	......		..	.80
*New York & New Jersey Tel. Co..	100	5,000,000	3,723,000	1½ % Q., Oct., '98.	148	148
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	90	93
†Commercial Union Telegraph Co...	25	500,000	500,000	3 % S., July, '98.	112	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	94¼	94½
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Dec 19:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	172½	...
Chesapeake & Potomac Telep. Co..	100	......	......	....	55	60
Chicago Telephone Co	100	......	......	......	2 0	..
Central Dist Prtg & Telg.Co.(Pgh.).	100	750,000	750,000	....	132½	134
Empire & Bay States Telegraph Co.	...	......	......	....	75	80
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	75	78
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2¾ % Q.	112	118
Providence (R. I.) Teleph. Co	50	....	......	....	89½	..
Southern New Eng. Teleph. Co	100	8,000,000	......		121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Dec 19:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
†General Electric Co. [old] com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new]...... "	100	18,276,000	18,276,000	......	92⅛	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2¾	8¼
Westinghouse Elec. & Mfg.Co.com.	50	......	146,700	....	39½	40⅛
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	62	..
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Dec 19:						
Edison Elec. Ill'g Co., New York..	100	9,138,000	7,988,000	....	190	192
*Edison Elec Ill'g Co., Brooklyn..	100	4,000,000	2,000,000	1½ % Oct., '98.	..	..
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	28	30
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	...
General Electric Co [new].... "	100	18,276,000	18 276,000	......	92⅝	93
Interior Conduit & Insulation Co...	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.—Dec 19:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	165	175
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Dec 19:						
Edison Electric Light Co	100	2,000,000	......	......	144⅛	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	57½	57⅝
*Electric Storage Battery Co...pfd.	100	5,000,000	..	......	66	67
‡ Kings Co. El. L. & P. Co	100	2,500,000	2,500,000	A. & O.	..	153
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co..	10	550,000	550,000	$82500 dis. Jan.11'97	13¾	14
Southern Elec. Light & Power Co..	10	187,500	187,500	....	13¼	..
Miscellaneous.—Dec 19:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	41	45
Missouri-Edison (St. Louis)....com.	..	......	......	....	21½	23½
Eddy Electric Mfg. Co	25	......	......	....	....	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	125	..
Hartford (Conn.) Lt. & Power Co..	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	177	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	84	..
Rhode Island Elec. Protec. Co	100	......	......	....	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q	‡ 162½	168½
Toronto (Canada) Elec. Light Co...	100	1,085,000	1,085,000	1¾ % Q	139⅝	140
Thomson-Houston Welding Co	100	......	......	8 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	100	..

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200. of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Dec 19:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh. Nov.16, '98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	92	100
New York.—Dec 19:						
Consolidated Electric Storage Co...	...	......	....	....	9½	16
Edison European	..	......	....	....	..	...
Safety Car Heating & Lighting Co..	100	......	....	......	108	...
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	85	40
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	101	102
Philadelphia, Pa.—Dec 19:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	--
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000.000	......	....	..	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	10	15
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	62	65
Welsbach Light Co	5	525,100	......	....	39½	40
Welsbach Light Co., Canada.	5	500,000	......	....	..	2½
Pittsburg, Pa.—Dec 19.						
Carborundum Mfg. Co	100	200,000	200,000	....	..	--
Standard Underground Cable Co...	100	1,000,000	1,000,000	Q	115	119
Miscellaneous.—Dec 19:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	18	16
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	60	...
Billings & Spencer Co	25	......	....	....	80	86
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	37	45
Johns-Pratt Co	100	......	....	....	90	100
*Pratt & Whitney Co..........com.	100	......	....	....	4½	8
*Pratt & Whitney Co...........pfd	100	.. ..	....	....	45	47
Stillwell-Bierce Co...........com.	..	......	....	....	..	...
Stillwell-Bierce Co.............pfd.	..	......	......	2 % Sept. 1, '98.	95	98
Shultz Belting Co	100	500,000	......	....	82	87
St. Charles Car Co	--	------	......	....	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Dec 19, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry.................1st mtg. 5s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*115½	......
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*114	115
‖Watervleit Turnpike & RR.1st mtg. 6s	350,000	350,000	1919	M. & N.	*120	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*116	....
Troy City Railway Co.................1st 5s	....	....	......	......	*106½	......

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Dec 19, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113	114
Baltimore Traction Co........1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	116	116⅛
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103	101
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	117	1·8
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	......	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co...........1st mtg. 6s.	96,000	117,000	1912	J. & J.	. ....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	115	116
City & Suburban Ry.......1st mtg. g 5	3,000,000	3,000,000	1922	J. & D.	116	.....
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113½
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	120¾	......

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR........1st mtg. g. 5s.	5,379,000	3,702,000	1924	J. & D.	104	105
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105¼
West End Street Ry........Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	. . .	
†Charleston City Ry...........1st mtg. 6s.	850,000	....	....	J. & J.	....	

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¾	103
‡Chicago Passenger Ry.......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry......1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	105½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	64½	......
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¾	.....
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	. . .	......
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	101½	....
North Chicago City Ry......consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	106½	107
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	103½	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	......
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	96	96¼
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Dec 19, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	3,000,000	2,500,000	1922	J. & J.	106	106¼
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103½	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	112¾
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	108	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119¼	......
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	131	134

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	105½	106
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	106	106¼
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	103½	105½
†Cleveland Electric Ry. Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	105	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1913	M. & N.	......	......
aEast Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	107	108
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry......1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	98½	100
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	. ..
The Detroit Ry................1st mtg. 5s.	1,800,000	1,800,000	1925	J. & D.	100	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1913	M. & S.	108	......
New Haven (Edgewood Div.) 1st mtg. 5s.	250,000	250,000	1914	J. & D.	107	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben, g. [illegible]	100,000	94,00[illegible]	19[illegible]	M. & S.	10[illegible]	......

*With interest. Unlisted.

PASSENGER RAILWAY.

New Orleans La.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR..........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	103	......
Crescent City RR.............1st mtg. 6s.	......	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83⅞	84½
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	104½
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	107¼	108¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	350,000	350,000	1907	F. & A.	111	....
Orleans Railroad Co........Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	89	....
‡St. Charles St. RR. Co.......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	106	......

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn).....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	110	111
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122⅝	......
Broadway & 7th Ave..........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	104	105
Broadway & 7th Ave...........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	114
Broadway Surface.............1st mtg. 5s.	1,125,000	1,125,000	1924	......	115	117
Broadway Surface.............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	105¼
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	118
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	115
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	......
Brooklyn Heights RR.......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	110¼	114
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	104	105
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	109	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	104	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111	113
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	120
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	103	105
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115¾	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	103½
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	...
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115½	117½
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	97½	99
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	124	....
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	12,500,000	1997	F. & A.	118	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	117¼	118
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.		. ...
Steinway Ry. (L. I.)........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	113½	115
South Ferry RR. Co...........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	128	......
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	......	..
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry......1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	114	116
‡‡Westchester Electric RR....1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112½

†$1,035,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry..............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Dec 19, 1898

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry............1st. mtg. 6s	350,000	310,000	1909	J. & J.	....	....
Empire Pass. Ry....................1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry..................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry....................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry..............Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	......	1943	......	105½	105¾
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J. & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry...............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co................Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s.	....	......	1905	......	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116¼

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	......	......
Central Traction Co................1st mtg. 5s.	375,000	375,000	1930	J. & J	110	....
Citizens' Traction Co..............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	......	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	......	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	...
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	108	108½
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	......	......
Second Ave. Traction Co......................5s.	2,500,000	2,000,000	1934	J. & D.	......	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	108½	110

St. Louis.

Date of Quotation—Dec 19, 1898.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR..........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 6s	[illegible]	[illegible]	1913	J. & J.	113	115

*With interest.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis. *Date of Quotation*—Dec 19, 1898						
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co.......................1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	108½	110½
Missouri RR. Co....	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co.............1st mtg. 6s.	400,000	300,000	1910	A. & O.	101	103
People's RR. Co.....................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co.....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co...............Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co.....................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100½	101½
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	105	107
St. Louis & Sub. Ry...............Income 5s.	800,000	800,000	......	....	65	70
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	113½	115
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	116½	117½

†Controlled by St. Louis RR. Co.
‡Controlled by Union Depot RR. Co.
¶Controlled by Lindell RR. Co.
‖$200,000 in escrow to retire 1st & 2d mtg.
§$600,000 in escrow.
††$200,000 in escrow to retire 1st mtg. bds.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
San Francisco Cal. *Date of Quotation*—Dec, 1898.						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	115½	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	114½	......
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	128½	129
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126	......
†Park & Cliff House RR.......1st mtg. 6s.	350,000	350,000	1912	J. & J.	106½	108½
†Park & Ocean RR................1st mtg. 6s.	250,000	250 000	1914	J. & J.	112	......
†Powell St. Ry........................1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	123
Sutter St. Ry. Co...............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......

†Controlled by Market St. Ry. Co.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Washington D. C. *Date of Quotation*—Dec 19, 1898.						
Belt Ry. Co.........................O . . mtg 5s.	500,000	450,000	1920	J. & J.	51	....
Columbia Ry.................... .... mtg. 6s.	500,000	500,000	1914	A. & O.	118	125
Eckington & Soldiers' Home. mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	128	......

†$50,000 in escrow to retire 1st mtg.bds.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation*—Dec 19, 1898.						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	108	......
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,548,000	1931	F. & A.	115½	116¾
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,866,000	1932	M. & N.	111½	112½
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	103	105
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	109	......
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	102	102½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	116	117
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	100	102
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	3,000,000	2,878,000	1928	J. & J.	104	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	105	......
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	......	.....	......
St. Paul City Ry......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	......	....

†$1,000,000 in escrow to retire 1st and 2d mtg. bds.
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.
‖$87,000 in treasury.
§$960,000 res'ved to redeem prior liens.
††$620,000 in escrow.

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass. *Date of Quotation*—Dec 19, 1898.						
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	109	110
Pittsburg Pa *Date of Quotation*—Dec 19, 1898						
Allegheny County Light Co................6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......
Miscellaneous.—(Dec 19, 1898.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	111½	......
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1998	......	121	..
Edison Elec. Illg. Co. (Brooklyn).......	2,500,000	1,500,000	1940	....	110	115
Edison Electric Light (Philadelphia)..	2,000,000	......	...	......	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation*—Dec 19 1898						
American Bell Telephone.....................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation*—Dec 19, 1898.						
American Electric Heating..............5s.	500,000	500,000	...	....	.15	.19
Armington & Sims Eng. Co..................	....	....	......	......	......	25
Barney & Smith Car Co......................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co......................6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co	[illegible]	......	......	......	......	....

*Unlisted †Nominal

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12.65@12.75c.; Lake, 12.75@13c.; casting, 12.65@12.75c.

The International Bell Telephone Company has declared a dividend of 6 per cent., payable January 4.

The directors of the Ridge Avenue Passenger Railway Company, Philadelphia, on the 14th inst. declared a dividend of $3 per share, payable January 1.

At Detroit a proposition for new thirty year franchises submitted by the street railway companies was rejected by the common council by a vote of 30 to 3.

A stock company has been organized at Cincinnati, with a capital of $500,000, to build an electric road from Cincinnati to Lebanon, a distance of 25 miles.

The New England Telephone Company has reduced its party line service rates in Boston to $48 and $30, the former for three, the latter for six parties to the line.

Stockholders of the Dayton, Springfield & Urbana Electric Railway Company at Springfield, O., have increased the capital stock of the company from $10,000 to $750,000.

The Hestonville Passenger Railway Company of Philadelphia has declared a dividend of $1.50 on its preferred stock and a dividend of $1 on its common stock, payable December 31.

The Westinghouse Electric & Manufacturing Company has declared the regular quarterly dividend of 1¾ per cent. on its preferred stock, payable January 3. Books close December 24 and reopen January 4.

The directors of the Western Union Telegraph Company have declared a quarterly dividend of 1¼ per cent., payable January 16 to shareholders of record December 20. Transfer books closed on the 20th inst. reopen on January 3.

The Denver City Cable Railway, Denver, Col., was sold at auction on the 15th inst., under foreclosure of a mortgage for $4,000,000, to the reorganization committee for $500,000, the minimum bid allowed. The West End Electric Railway was also sold under foreclosure, being purchased by the same parties, for $40,000.

The controlling interest of the Wilmington City Electric Company, Wilmington, Del., has, it is announced, been sold to a syndicate of out of town capitalists. A few of the officers of the company pooled their stock and thus got the control. By the terms of the agreement, it is said, the minority stockholders will be taken care of.

Edward Lauterbach, counsel for the Third Avenue Railway Company, says that the power plant the company proposes to erect at 216th street, New York, will have a capacity of 64,000 horse-power, which will make it the largest in the world, unless the Metropolitan Street Railway Company carries out its intention of making its building a 70,000 horse-power plant. The Third Avenue Company may, Mr. Lauterbach says, go into the business of selling electricity also.

The Fairmount Park Transportation Company, Philadelphia, asked permission to increase its bonded indebtedness $150,000, making an aggregate of $500,000, and the Fairmount Park Commission has given its assent. Senator Porter, president of the company, explained that there was a floating debt of $140,000 and no money on hand to pay it off. The company's earnings had been used to construct a bicycle track and casino, and the new issue of bonds, he thought, was the best way out of the difficulty.

The purchase by John D. Crimmins of a large plot of ground in the neighborhood of Hell Gate has led to the belief that a great electrical power plant will be erected there for the purpose of supplying power and light in the upper sections of the boroughs of Greater New York. It is said that Mr. Crimmins is acting with the Whitney syndicate, and that the above purchase is part of the scheme that the syndicate has in view, that is, control of electrical supply in New York and its suburbs.

The St. Louis papers say that negotiations are on for the sale of the Missouri-Edison Electric Light & Power Company of that city to an Eastern syndicate of which H. B. Holland & Co. of New York form the head. It is understood that an option on the plants, properties and franchises of the company has been given and that the Eastern financiers are now arranging to carry the deal to consummation. The company has $2,000,000 common stock and $2,000,000 preferred, and $4,000,000 of 5 per cent. bonds. Of the bonds, $1,100,000 are in the treasury to redeem a like amount of bonds of the old Missouri Electric Light Company which were outstanding at the time the reorganization was effected.

A syndicate, headed by Col. G. B. M. Harvey of New York, is reported to have purchased the franchise for an electric street railway in Havana, Cuba. The franchise purchased was claimed by the Ferro Carril Urbano Street Railway Company of Havana on an old grant, but they have yielded their rights to the new company at a set price amounting to $1,472,000. Col. Harvey, when asked who are the principal members of his syndicate, said: "Hanson Brothers of Montreal, the Bank of Nova Scotia, the Bank of Toronto and F. S. Pearson of Halifax. Those chiefly interested in New York, aside from Mr. Pearson and myself, are Harry Payne Whitney, W. K. Ryan and Senator Smith of New Jersey."

George Foster Peabody, vice-president of the Edison Electric Illuminating Company of New York, in denying the statement made by John D. Crimmins that that company had sold out to the W. C. Whitney syndicate, said: "Of course all commodities which are bought and sold usually have their price. For instance, I would sell out my interest in the Edison Company for $500 a share, but I have no idea anybody will offer me that price. The new syndicate will not be able to harm our business. Ours is the only large company that is making money, yet we have voluntarily reduced prices. We are now contemplating another reduction which will make it exceedingly hard for Mr. Whitney's company to supply power at a profit."

The consolidation of all the electric, cable and suburban street railways in and around Baltimore, Md., was effected on the 17th inst. by the signing of the necessary papers. The deal was conducted by the Baltimore banking house of Alexander Brown, acting for the Elkins-Widener-Dolan syndicate, in which English capital has a considerable interest. The lines consolidated are the Baltimore City Passenger, the Consolidated, the Baltimore & Northern and the Baltimore, Middle River & Sparrows Point companies. Neither sells to the other, but the properties are merged and will be operated under one management. An issue of 4 per cent. bonds, covering the cost of the City Passenger Railway Company, has been arranged and will be brought out by Alexander Brown & Sons and the Mercantile Trust & Deposit Company. The bonds of the Baltimore & Northern and the Baltimore, Middle River & Sparrows Point Railway companies will not be disturbed.

At the meeting of the board of aldermen at Chicago on the evening which was to decide the fate of the so-called Yerkes franchise ordinances, and on which they were side-tracked by a vote of 38 to 25, the only approach to trouble was during a speech by Alderman McInerney, who was advocating the passage of the ordinances. While he was talking the sound of drums and trampling feet were heard. With blanched faces all listened, but Mayor Harrison sent out and suppressed a drum corps at the head of fifty men. The death of the ordinances was so well assured that the big crowds stayed at home.—At the meeting of the aldermen on the 19th inst., a resolution was passed by a vote of 32 to 31 transferring all franchise ordinances from the committee on streets and railroads to the committee on city hall, and this committee can prevent any further action on them until the Allen law is repealed. This is considered a finishing blow to the Yerkes franchises

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EDITORIAL NOTES.

The Old and the New Year. The year which is about to draw to a close cannot justly be said to have been productive of any very startling changes in the electrical industry.

No new electrical patents have been granted that will be likely to revolutionize prevailing systems as did the telegraph and telephone, and with the possible exception of two inventions, one made abroad, the other in this country, nothing of a striking nature can well be credited to the year 1898. As in 1897 Mr. Tesla was credited with having thought out a method of utilizing the sun's heat for the generation of steam, as well as a scheme for removing disease germs from the human body, so for 1898 the theory of transmitting electricity without wires through upper strata of the air and over enormous distances may be placed to his account.

Early in 1898 an Austrian Pole by the name of Szczepanik first startled Europe and then this country by announcing that he had devised a method of seeing by electricity. Considerable was written on the subject at the time, and in fact it attracted the attention of scientists the world over, although comparatively little information regarding the method of accomplishing this wonderful feat was allowed to leak out, it being to all intents the desire of the inventor to withhold all details of the device until it could be given the public through the medium of some international exposition.

Although no very striking changes have taken place during the past year in electric lighting, if we except possibly a greater use of the enclosed arc lamp, due to its having reached a high state of perfection, and the ability to transmit current for lighting purposes over constantly increasing distances and at pressures ranging between 20,000 and 30,000 volts, the lighting industry has been continually growing, as may be gathered from the fact that in 1880 there were but three electric light and power establishments in the United States, employing but about 230 persons, whereas the investment in electric lighting stations in this country to-day is estimated at over $600,000,000.

In the field of electric traction considerable progress has been made. The old year has seen the introduction of horseless carriages to an extent heretofore unprecedented, and what is more, this mode of locomotion would seem to be gradually growing in popularity. As to whether the horseless carriage is proving a financial success is another matter, and would seem rather doubtful from the information that can be gathered. As a motive power for street railways, electricity is more than ever in demand and is rapidly being substituted for every other form especially in New York City and its vicinity.

The year 1898 has unquestionably seen several rather important changes in financial circles of the electrical industry, not the least among these being the reorganization of the General Electric Company by a scaling down of its capitalization brought about to a great extent through the untiring and persistent efforts of Electricity. Unfortunately for the industry as a whole, the year about to expire has also seen an increase in the tendency of large financial interests to gain control of and combine electrical enterprises, ostensibly for economic reasons but really for stockjobbing purposes, which cannot in the long run but work harm to small manufacturers and dealers as well as throw many worthy persons out of employment.

In many respects the year 1898 has been a fairly satisfactory one to the industry in spite of the war, which, as was only to be expected, tied up a large amount of capital that otherwise would probably have been expended in electrical undertakings of various descriptions. There was considerable demand for our electrical machinery in foreign countries. Just how great this demand was may be gathered from the fact that for the fiscal year ending June 30, 1898, the amount of exports represented $2,052,564. Our best customers were Great Britain, France, Argentina and Japan, in the order named. That American electrical machinery is finding ready sale in foreign countries cannot be doubted, and this is undoubtedly due to the comparative cheapness of the United States manufactures owing principally to improved labor-saving machinery.

For the coming year the outlook is certainly more promising than it has been for some time. This country being again at peace with all nations, and likely to remain so indefinitely, it may safely be predicted that there will be a large investment of capital in new electrical undertakings such as the development of water powers and the construction of street railways and lighting plants. A field which it will not do to ignore is that of the telephone, as many new independent companies are being organized each month.

The year 1899 should see a material increase in the export of electrical apparatus, as a more systematic effort will be made to gain a firmer foothold in South America, the far East, and especially China. The general tone of business throughout this country is unquestionably improving, and there are many lines of trade in a very healthy condition. Such being the case, we trust the coming year will find the electrical industry fanned by the zephyrs of prosperity. Hoping to see this laudable desire gratified, we wish all our friends a Happy New Year.

A Transatlantic Telephone System. About a year ago we referred editorially to a scheme that was said to be on foot looking to the establishing of a transatlantic telephone line. The movement was at that time said to be backed by influential capitalists as well as by a number of telegraph and telephone companies. No reliable information was allowed to leak out as to how it was proposed to overcome the seemingly insurmountable difficulties to be met with, but it was asserted that the problem of overcoming static induction which had heretofore been the chief stumbling-block in the way of transatlantic telephony had been successfully grappled with. Nothing further being heard of this proposed gigantic undertaking the interest in it naturally died out. The question was again recently brought up, however, by an article which appeared in one of the daily papers referring to an interview with Mr. Thomas Edison. In this article Mr. Edison stated that he was prepared to construct a telephone line completely around the world providing sufficient capital was forthcoming for the purpose. Fully appreciating the seeming impossibility of overcoming static induction in a long submarine telephone cable, which, as is well known, changes the quick short sound waves into long slow vibrations impossible for the human ear to detect, he suggests a rather unique and decidedly costly method of entirely eliminating all trouble from this source. Mr. Edison, referring to the project, says:

"Telephoning across the Atlantic Ocean will have to be done on new lines. This is probably the feature of the plan that will be most questioned. Inventors have been at work for years trying to send telephone messages across the Atlantic, and have failed every time. Nobody will be able to telephone directly from Europe to America until some force more powerful than electricity has been discovered.

"Rather than attempt the impossible, I tried the plan of constructing cables upon new principles, but I met with the same baffling results. I had, in fact, about given up the task as hopeless when the idea occurred to me that if the length of the cable under water were not so great success might be easier. This led to experiments whose success convinced me that the difficulty would be solved by laying a new cable for telephone purposes only and working it in relays of fifty to one hundred miles or less.

"The idea is to send out sounding parties between the coasts of the two continents for locating shoals. Over each shoal would be anchored a float or ship like the 'lightships' off Sandy Hook and elsewhere."

In other words, Mr. Edison's idea would be to anchor ships at given distances across the Atlantic Ocean, each vessel being used as a relay station. To the best of our knowledge there is no submarine telephone cable in actual use over thirty miles in length, and that would apparently seem to be the extreme distance over which telephone messages can be transmitted with any degree of success. Such being the case, it would require not less than sixty-six relay stations to enable a message to be transmitted between Great Britain and this country. As may readily be inferred, the carrying out of such a project would entail an enormous expenditure of money, and unless the chain of relay stations were located far out of the course taken by transatlantic steamers they would be a serious menace to navigation. Moreover, there would always be a danger of these vessels breaking loose from their moorings during very rough weather, as well as a chance of some of them being destroyed by icebergs. Taking it all in all, although the idea might be successfully carried out by an expenditure of millions of dollars, the results to be derived would seem scarcely to warrant such an enormous outlay of money with the attending risks.

The Disposing of Street Railway Franchises. The granting of several valuable franchises by the city of New York to the Metropolitan Street Railway Company and to the Third Avenue Railroad Company for an extension of its lines is attracting considerable interest, coming as it does just after the recent excitement on the franchise question in Chicago, where the city's interest was protected only after the most extreme measures had been resorted to.

The combination which comprises what are known as the Fort George & Elizabeth Avenue Railway Company, the Boulevard & Eleventh Avenue Railroad Company, the New York & Harlem Railroad Company and the Eighth Avenue Railroad Company, all under the control of the Metropolitan Street Railway Company, applied for a franchise for a double track road, to be operated by underground trolley, along the Boulevard north from Manhattan street to 182d street, which is just north of Washington Bridge. These same companies also desire to construct cross-town lines in 135th street from Madison avenue to Eighth avenue and in 145th street from the Boulevard to the Harlem River. The franchises asked for by the Kingsbridge Railroad Company and the Southern Boulevard Company, both controlled by the Third Avenue Railroad Company, cover the old Kingsbridge franchise, and in part laps over that asked for by the Metropolitan Street Railway Company. The line in question runs from Manhattan street north on the Boulevard to 169th street, thence along Kingsbridge road to the Ship Canal, across the latter as well as over Spuyten Duyvil Creek, through 230th street to Riverdale avenue and north to the city line. Several less important franchises are also asked for, but the above are by far the most valuable.

After the price and conditions of sale have been agreed to by the Board of Estimate, the result will be laid before the two houses of the Municipal Assembly. Here a four-fifths vote of the members is necessary to approve the terms, the final approval of the sale, however, resting with the Mayor. The terms that have apparently so far been suggested are as to whether the city shall accept a gross sum for the franchises or a percentage of the gross earnings of the railroads on the lines granted; or shall the right to operate cars be for but twenty-five years, with the privilege of renewal for twenty-five years more; or shall the city reserve the right to take charge of the railroads at the end of twenty-five years and operate them as a municipal undertaking?

The granting of a street railway franchise for but twenty-five years, even with the privilege of renewal at the end of that period, would scarcely be conducive to good results, as any railway company might naturally hesitate to expend a large amount of money for a first-class road when at the end of a comparatively short space of time its franchise might be withdrawn. As to the city's reserving the right to take charge of the railways at the end of a given period with a view to operating them as municipal undertakings, it should not be thought of for a minute. Municipal ownership of street railways has heretofore not been of a character to warrant such a step being taken. There still remains the plan of accepting a gross sum for the franchises or a percentage of the gross earnings. Either of the last named arrangements would seem to be far preferable to the other schemes suggested, and of the two that of accepting a percentage of the gross earnings is probably the best. If we are not mistaken, there are several franchises in Massachusetts that have been granted in that manner with satisfactory results.

Europe would seem to be appreciating the advantages of the telephone. Frankfort, Brussels, Antwerp, Liege and Verviers are now connected telephonically, and another international line has been opened between Frankfort and Basle.

DEATH OF RONALD T. McDONALD.

We regret to have to announce the death of Mr. Ronald T. McDonald, which occurred suddenly at Dallas, Texas, on the morning of the 24th inst., occasioned, according to the latest advices, by pneumonia. Mr. McDonald was born in 1849, and after serving in the Civil War engaged in mercantile pursuits until 1882 when he entered the electrical field. For a number of years past Mr. McDonald had been a well-known figure in the electrical industry and had ever shown himself a man of indomitable energy and full of resources. His one aim in life was to succeed in everything he undertook, apparently caring little in what manner the results were brought about so long as the desired goal was reached. Many curious incidents are related of Mr. McDonald's experiences which go to show the pluck and resources of his nature when called forth in times of emergency. One of his old-time friends relates the following incident: When Mr. McDonald was in the drygoods business in Michigan, before his entrance into the electrical field, a patron of his in a country town owed him quite a large bill and Mr. McDonald went himself to collect it. On his arrival he discovered to his consternation that the man's place was closed and that the man himself could not be found but it was rumored that he was getting papers ready

RONALD T. McDONALD.

for an assignment. Mr. McDonald hastened to procure an attachment on the goods in the store; the sheriff stated he could not make the attachment as the store was locked and there was no way of getting in. The sheriff added that were the doors open he could readily make the attachment in time to secure Mr. McDonald's claim. Quick as a flash the latter seized a plow that was standing in front of an adjacent store, and using it as a battering-ram broke in the door. The sheriff then walked in and made the attachment and Mr. McDonald saved his claim.

After a successful commercial experience Mr. McDonald started in the electrical business in 1882 in connection with Mr. Charles D. Jenney, now of Indianapolis, and his father. They manufactured arc light machines for a number of years, disposing of them in large numbers to municipalities, at which work Mr. McDonald was an adept. This corporation was known as the Fort Wayne Jenney Electric Light Company, the controlling interest being afterwards purchased by Mr. Coffin for the Thomson-Houston Electric Company. For some time thereafter Mr. McDonald and Mr. Coffin were warm personal friends and conducted together many operations of considerable magnitude. A short time after the formation of the General Electric Company Mr. McDonald became dissatisfied with the manner in which his company was being handled, and organized the present Fort Wayne Electric Corporation, of which up to his death he was president. By exceedingly bright manœuvers he succeeded in getting possession not only of the factory of the old Fort Wayne Company, but of practically all of its assets as well, much to the disgust of the General Electric Company.

During the legal difficulties which arose over the acquisition of the assets of the old Fort Wayne

company, Mr. McDonald leased the Wenstrom factory in Baltimore and used it as a club to bring the General Electric Company to terms. In addition to his interests in the Fort Wayne Electric Corporation, Mr. McDonald was a large owner in the New Orleans Edison Electric Light Company as well as in the New Orleans Artificial Ice Plant. He was also a stockholder in the Hoffman House, New York, a large owner, with Mr. Samuel Insull of Chicago, in the Fort Wayne Lamp Company, and other enterprises.

Mr. McDonald was a man of untiring energy, one of the greatest "hustlers" in the electrical industry and withal a pleasant and agreeable companion. By his death the industry loses a man who made his mark on the pages of its history even if the mark was sometimes blurred by methods that subjected him to severe criticism. He was a resident of Ft. Wayne, Ind., where he leaves a devoted family to mourn his untimely death.

Under the Searchlight.

Notes and Comments on Various Topics.

PROF. W. C. ROENTGEN, the inventor of X-ray photography, has been offered a chair in the faculty of philosophy in the University of Leipsic.

* * *

IT is true, according to the Boston *News Bureau*, that the Rev. P. F. Jernegan, of Electrolytic Marine Salts fame, has returned to this country $75,000 which has been deposited beyond attachment but in such a way as to be the basis of negotiations for his return to this country. "It is understood," says the *Bureau*, "that Mr. Fisher, his partner, received a considerable amount of money paid to Jernegan, and Mr. Fisher's whereabouts are as yet unknown. Besides the $75,000 there is also $99,000 of Mr. Jernegan's money 'held up' in this country in the interest of the company. The company itself has $101,000 cash, $5,000 worth of bullion, $2,000 worth of platinum wire, three houses and two plants at North Lubec. Messrs. Sawyer and Usher, the fiscal agents of the company, also have $113,000, which is available for the stockholders provided all the stock is turned in and there are no complications. There is against this money only $18,000 of debts and 950,000 shares of stock outstanding. The company thus has in sight cash assets of $377,000, or nearly 40 cents per share, that with smooth sailing should be available to shareholders."

* * *

THERE are now at least two electric delivery wagons running in New York City, trim and handsome vehicles both of them, with electric side lights and electric lights inside in place of the lamp or lantern commonly carried. The bodies are very similar to those of ordinary delivery wagons, but besides they have pneumatic-tired wheels, lower than those of the usual wagon.

* * *

ACCORDING to the *Milwaukee Sentinel*, Mr. Samuel W. Watkins, who is manager of a firm that manufactures tanks which hold compressed air, and who has made a study of compressed air power, states that there is little or no economy to be hoped for through the operation of street cars by compressed air in view of the development and possibilities of electricity. Mr. Watkins says that a compressed air system of cars would not only cost more to build than an electric car line, but the operating expenses and the wear and tear would be much greater because of the delicate and accurate machinery that is needed. Providing the above proves to be the case, it looks very much as though Mr. Joseph Leiter was on the high road to another failure.

THE PURIFYING AND STERILIZING OF WATER BY OZONE.*

Water is undoubtedly one of the most important articles of human subsistence and yet strange to say it is water which is the principal agent in propagating contagious diseases; thus nature apparently feeds the human race in a manner that entails almost certain death. However, if man would take the trouble to examine his conscience he would not fail to perceive that he is to a great extent responsible for this wholesale poisoning by water, for does he not throw into streams all manner of organic matter which he does not know how else to dispose of? Fire purifies everything; he is aware of this fact and yet does not make use of it, and in this he is culpable, preferring, it would seem, to poison his neighbors, who one may be sure will do him the same bad service. Health societies and physicians have repeatedly cried out against this dumping of filth in water courses; but what can be done to eradicate a bad habit that has been for years taking root? Can we prevent those who dwell along a river's bank from throwing into the stream which passes before their doors all that of which they wish to be rid? As for ourselves we do not think there is any way possible. Thus the question of sterilizing, or at least purifying the water was brought up, for it is absolutely necessary that the microbes which dwell in the water in innumerable quantities, awaiting a favorable opportunity to ingraft themselves in man's system, which offers an extremely favorable field for their development, should be destroyed at any cost. Filters have had their day, their inefficiency being generally recognized, as they only serve to remove the impurities held in suspension in the water while allowing the most deadly microbes to pass.

Pure air is a medium rather unfavorable to microbes, but the more deadly manage to exist in it; where however they no longer can exist is in ozone, whose beneficent effects are already beginning to be recognized. Thus the idea of circulating ozone through water, in which disease germs are almost invariably present, has been thought of with a view to destroying them almost completely. This may be achieved in several ways, but we will only speak for the present of Mr. Tindal's system which has so far given very remarkable results. That system is explained as follows: Before the air is made to pass through the volume of water to be purified it is subjected to the action of a high tension electric current obtained from a dynamo similar to those made use of for lighting purposes. The voltage is raised by means of specially designed transformers. The currents employed by Mr. Tindal at the municipal works of Saint Maur, where his system is now in operation, have a potential of from 50,000 to 100,000 volts. The electric current is led to specially designed receptacles where a current of dry air is made to circulate, and it is in these receptacles that a greater portion of the air is transformed into ozone. This ozonized air is then transmitted by means of an air pump to large columns or receptacles known as sterilizers in which the water to be purified enters at the same time as the ozonized air. In order to insure a thorough mixture of the air and water—that is to say, in order that each molecule of air should come in contact with at least one molecule of water, and on the other hand to allow time for the sterilization to take place, there have been placed in the sterilizers, at every fifty centimeters, celluloid plates pierced with innumerable small holes. By this arrangement the water is broken up into fine drops and circulates but slowly. The sterilizers installed by Mr. Tindal at the municipal works of Saint Maur are shown in Fig. 2. After leaving the sterilizers the water, then in an absolutely pure state, is collected in a small reservoir from whence it is distributed to Paris by means of pumps. The works of Saint Maur, of which a general view is given in Fig. 1, are capable of furnishing 100,000 meters of sterilized water per day. The cost of sterilizing a cubic meter of water, according to Mr. Tindal, amounts to less than .14 of a centime (about .028 of one cent). Moreover, Mr. Tindal is of the opinion that for other installations the above figures could be reduced by one-half. As may be seen, the above is a very small amount to expend when the health of the inhabitants of a large city is taken into account, especially as the amount expended in this way would be to a great extent offset by a saving in doctor's bills, to say nothing of an almost certain decrease in the mortality.

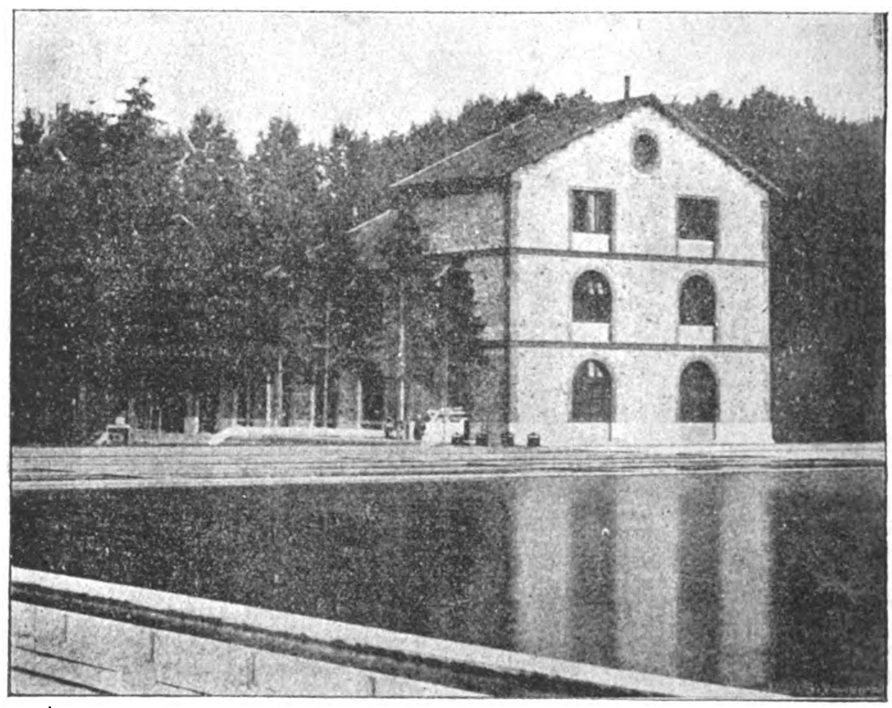

FIG. 1.—GENERAL VIEW OF THE SAINT MAUR WORKS NEAR PARIS.

Towns and small cities about to erect plants for lighting purposes could thus, apparently, with the same dynamos, purify their water supply. From an economical standpoint, therefore, Mr. Tindal's system would seem to offer many advantages.

Let us now say a few words as to the results obtained by Mr. Tindal from a bacteriological standpoint. With this object in view we will refer to a number of experiments made with extremely de-

* Translated from *La Vie Scientifique*, Paris, for ELECTRICITY.

fective apparatus at the International Exposition of Brussels. The plant in question allowed of about 700 cubic meters of water being treated, which was taken from the city's supply. The water of Brussels, coming as it does from great depths, has in it comparatively little organic matter (.045 to .075) and but few microbes (500 to 1,000 per cubic centimeter). In the various tests that were made it was found that the water was completely sterilized after its treatment with ozone.

Experiments were also made with water taken from the Ostend supply, from the Plassohendaele canal and from the Bruges canal; these waters are all rich in microbes. The Ostend water contains 6,848 per cubic centimeter, that from the Plassohendaele canal 389,280 and that from the Bruges canal 1,430,000. The analyses of the various samples however, after being subjected to the ozone treatment, showed them to be absolutely sterilized.

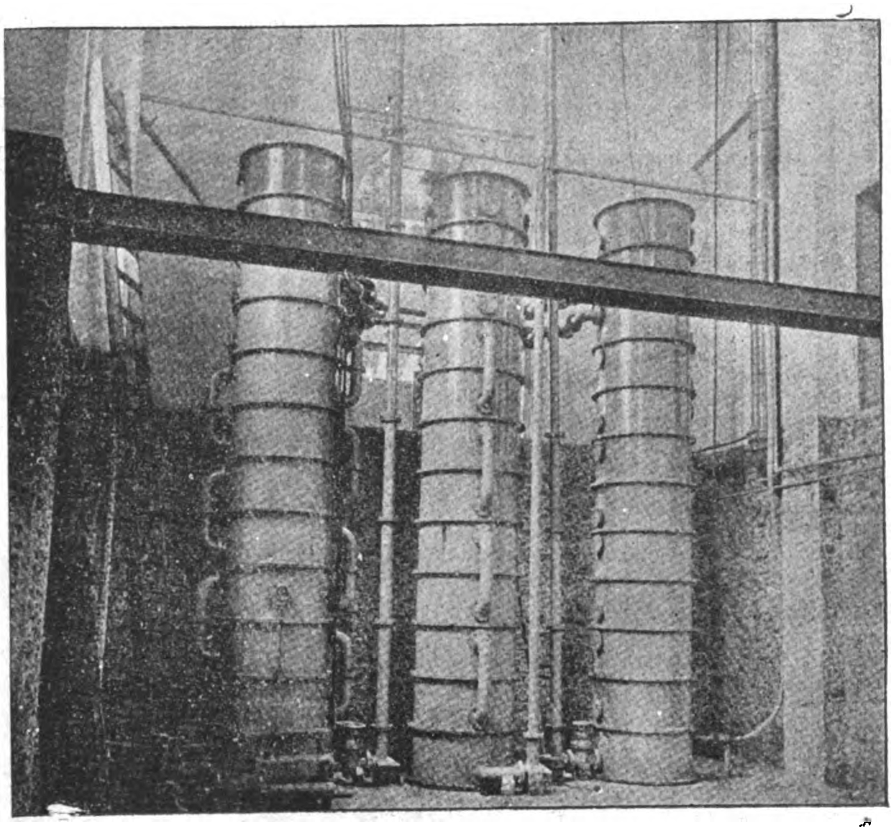

Fig. 2.—View of the Sterilizers at Saint Maur Municipal Works.

POLYPHASE TRANSMISSION OF POWER.*

BY F. WALLIS.

The transmission of energy by polyphase currents has made much greater progress abroad than it has in this country, and in addition to our national conservatism in adopting new methods there are two main reasons for our backwardness. In the first place, there are but few sources of water power in Great Britain, and recently steam power can be obtained comparatively cheaply all over the country. In Switzerland and in America, where long-distance transmission has made such strides, water power in large quantities is constantly to be met with, and is naturally taken advantage of; while again, in the mining districts of both America and South Africa, fuel can often only be obtained at very great cost, and consequently it is cheaper to transmit power over a great distance from one large center, where water power or fuel can be more easily obtained, than to have a number of isolated plants.

Nevertheless there is a considerable field even in this country for the transmission of power in large quantities over long distances—say 20 to 40, or even 50, miles—for not only might great generating stations be erected near the coal pits, where fuel can be obtained delivered to the boilers at 2s. 6d. per ton, but further, the enormous power that runs to waste in our blast furnaces might be in part utilized for the generation of electricity. It has been estimated that, for every 100 tons of metal cast, energy sufficient to generate 2,000 HP. for one week is wasted in blast-furnace gas, and that throughout the country about 2,000,000 HP. is thus wasted.

But quite apart from such problematic schemes there are many cases in which polyphase transmission might be advantageously employed. For instance, at Dublin where the generating station is only seven miles from the furthest sub-station and the pressure employed is only 3,000 volts, polyphase transmission has been found to give admirable results. Indeed, wherever it is desirable to work at a pressure of 2,000 or 3,000 volts or more, polyphase transmission offers many advantages. Again, in many cases where the generating station is within a few hundred yards of the area of supply, the polyphase system may be profitably adopted, owing to its suitability for motor work. This particularly applies to the case of the transmission of power in works where motors form the chief part of the load. And it must be borne in mind that even though there may not be many openings for long-distance transmission at voltages of 10,000 or so in England, many such transmissions are required in the colonies and elsewhere abroad, and it is preferable that the necessary plant should be installed by English engineers.

The question thus arises, What is the greatest distance to which electrical energy can be economically transmitted, and how do the various systems of transmission compare with one another? The largest circuit yet employed has been the experimental one between Frankfort and Lauffen, a distance of 100 miles, over which 300 HP. have been transmitted at 3,000 volts, three-phase currents being employed; 4,000 HP. have also been transmitted on the three-phase system at 10,000 volts over 24 miles at Sacramento, and 1,400 HP. at 11,000 volts over 35 miles at Fresno, Cal., not to mention the Niagara-Buffalo line, and many others. There are also several two-phase lines at work. Of single-phase alternating lines, that at Rome may be mentioned, where 2,000 HP. are transmitted at 6,000 volts from the Falls of Tivoli, 18 miles distant from the city. M. Thury and others have also installed several long-distance continuous current plants, of which that at Geneva, where 400 HP. at 6,600 volts are transmitted over 20 miles, is the longest, though the Brescia line, over which 700 HP. are transmitted 12 miles, is worked at the highest voltage, namely, 1,500. In the case of many of these transmissions, where water power is employed, it must be remembered that the power available is greatly in excess of that required, and consequently very considerable losses in the line and plant could be permitted.

Abroad, transmission of power is almost invariably carried out by bare overhead wires. In England no such transmission on any large scale has yet been tried, and it is more than probable that the Board of Trade would insist on insulated cables being laid either underground or by the side of a railway, or in some such thoroughly safe and efficient manner, whenever a high voltage was employed. And in many ways this would be an advantage, for any long-distance transmission would necessarily be on a very large scale and any breakdown which might easily occur with overhead wires would cause great loss to the community. Further, overhead wires have great inductive effects, and in a crowded country like England would cause much trouble. The underground mains would, of course, be either concentric or laid very close together.

In other countries the conditions are, as a rule, entirely different. The chief consideration is generally small first cost, and consequently bare overhead conductors are almost universally employed. But even with these there are limits to the voltage which may be employed; not, indeed, in the apparatus at the ends of the line, for transformers can be made to safely stand almost any voltage, but in the line itself. In a very dry climate 20,000 or 30,000 volts may be safely employed, but in a damp and foggy atmosphere, even 10,000 volts may be too high for satisfactory working, owing to moisture collecting on the insulators, and so causing short circuits.

But, granted a long-distance transmission, the question still remains, How does the polyphase system compare with the direct-current and with the single-phase alternating? Now, though direct currents have been employed by M. Thury over considerable distances at very high pressure (e.g., the 15,000 volts at Brescia), there are many disadvantages connected with such a system. In the first place, as M. Thury himself states, the maximum output of a high-pressure continuous-current dynamo is about 45 amperes at 3,000, or at most 4,000 volts; hence, for generation at 15,000 volts, four or five machines must be coupled in series; and likewise, wherever it is desired to tap the mains, another four or five machines in series must be run as motors, each either helping to drive a common shaft, from which a large generator may be driven to supply the lower potential current required for distribution, or driving its own smaller generator direct. In other words, large units with the corresponding gain in efficiency and in first cost cannot be employed with the continuous-current system. And, further, since commutators must be employed at the full potential of line, the risk of accident to the attendants or to the machines themselves is very great. On the other hand, the employment of the direct current admits of a saving in the weight of copper in the line as compared with any of the alternating systems, the relative figures for direct current, single-phase, two-phase, four-wire and three-phase circuits being 0.50 : 1.00 : 1.00 : 0.75, assuming the same maximum potential difference in each case. As a matter of fact the gain in copper is even greater, for in almost all alternating circuits the power factor is less than unity, and consequently a greater current has to be carried than corresponds to the power transmitted. On the other hand, in the above figures it is assumed that the maximum alternating EMF. is $\sqrt{2}$ times the effective EMF., and though this is approximately true it should be remembered that the disruptive dis-

*From the *Electrician*, London.

charge due to an alternating EMF. is sluggish; that is to say, does not at once follow the applied EMF., so that, to take an instance, an alternating EMF. of more than $\frac{15,000}{\sqrt{2}}$ effective volts is required to produce the same disruptive effect as a continuous-current EMF. of 15,000 volts. Further, there is no electrolytic effect with an alternating current, nor does the osmotic effect, whereby moisture creeps to the negative pole of a continuous-current circuit, exist. Of course, with underground cables these effects would not, under normal circumstances, be present; yet should by any chance a minute leak develop they would at once manifest themselves.

On the whole, in the majority of cases it will be found that though there would be a considerable saving of copper in the line, the continuous-current system is placed out of court by the fact that the generators and motors have to be split up into comparatively speaking small units, and that a considerable element of danger is always present owing to the necessarily more or less exposed commutators being at high potentials above the earth.

The single phase alternating system is well adapted for the transmission of power over long distances when it is simply a case of one receiving station where the one or two large motors convert all the energy at once into its mechanical equivalent. In the text-books it is shown that the system requires more copper in the line than the three-phase, the proportion being 100 to 75; but, as large single-phase motors, such as have just been referred to, are always synchronous and there is practically no lagging current in the line, whereas with a three-phase transmission the power factor will rarely exceed 80 per cent. and the line wires have to be increased proportionately in size, it follows that there will not in practice be much difference in the weights of copper employed. The real objections to the single-phase system are two in number—first, that the motors employed have to be of the synchronous type, and secondly, that rotary converters designed to transform single-phase alternating current into continuous current cannot be built for an output much above, say, 50 kilowatts, on account of the excessive sparking at the commutator, this sparking being due to the great fluctuations in the alternating current in the armature. A synchronous motor might, of course, be arranged to drive an entirely separate continuous current dynamo and the sparking difficulty so got rid of, but the cost of the two machines would considerably exceed that of a polyphase rotary converter, and the efficiency of the conversion would be lower. But the chief objection to the single-phase system is undoubtedly that first mentioned, namely, that synchronous motors have to be employed which cannot be started without external aid, and further require separate field excitation. This does not matter so much in a large transmission, where power is simply sent from one end of a line to the other in large quantities, for in such a case the cost of the exciter, and of the battery of accumulators or the small non-synchronous motor required for starting purposes, does not bear a large proportion to the total cost of the installation, nor is the extra attendance required for these a serious item. But where only small motors are concerned such complications become prohibitive; and though many induction and other self-starting motors have been brought forward, none have yet proved themselves sufficiently satisfactory for general adoption, or at least, as a matter of fact, have not yet been generally adopted. It should be added that synchronous motors may be started not only by small subsidiary self-starting motors, or by driving their exciters as motors from a battery of accumulators, but also by supplying the exciters from the alternating current mains when, provided their field-magnets are laminated, they will run as alternate-current motors. But this method involves the use of the laminated fields and other complications, and does not seem to be often employed.

With the polyphase system the difficulty of self-starting is entirely done away with. Even synchronous polyphase motors will start themselves, owing to the reaction of the eddy currents induced in the solid pole-pieces—provided the pole-pieces are solid and not laminated at the tips, as is often the case; but as the resulting torque is not very great, the motors have to be started light and the load only thrown on when they are running in synchronism. Synchronous motors have the great advantage of a power factor of nearly unity when properly excited, and hence, if three-phase synchronous motors are employed, there is a saving of 25 per cent. of the line copper over the single-phase system. But in spite of their lower power factor, induction motors are far more generally employed on polyphase circuits. With these there is no difficulty in starting, even under full load. Small motors up to 10 HP. or so are generally made with squirrel-cage rotors, and these when starting under full load take for a short time a current of two or three times the normal full load value. Larger machines are provided with a variable resistance in the rotor circuit, and will start under full load, taking only the normal current. For cranes and hoists the rotors are wound to have a considerable resistance and a starting torque of even five times the normal can be obtained.

Further, the polyphase system has the advantage of being peculiarly well adapted for use with rotary converters. A three-phase current can thus be transformed into a single-phase, a two-phase or a continuous-current, though for conversion into single-phase or two-phase it is far simpler and more efficient to use static transformers. For conversion into continuous current, however, rotary transformers must be used, and since in polyphase systems the flow of power is constant there is no difficulty with sparking at the commutator. Indeed, the tendency to spark, and the demagnetizing effect of the armature, is far less than with continuous current dynamos, since the armature reactions of the two circuits tend to neutralize one another. Thus we are told that the 600 kilowatt converters at Niagara will give 900 kilowatts without sparking.

It is rather a drawback to the use of the rotary converter that as a rule it requires a static transformer to reduce the polyphase voltage before it reaches the machine. The reason is that continuous currents are always required at low voltage, and a rotary converter with only one armature winding has a fixed ratio between its polyphase and continuous current voltages, the former being lower than the latter. But even were any voltage ratio possible it would still be undesirable to introduce high potential currents into a revolving armature, and static transformers would have to be employed. From what has been said it must not be inferred that static transformers must necessarily be employed with motors, for such is not the case. The polyphase circuits can be, and in large sizes generally are, led into the stationary portion of the motor, where they can be as well and safely insulated as in a transformer itself. Small motors, however, cannot be wound for high pressure except at prohibitive cost—the limit for a 20 HP. motor being about 1,000 volts—and with these static transformers must be employed.

Thus in a large transmission system large motors will take current direct from the high-pressure mains, while for smaller motors one or more distributing centers with large static transformers will be established. Lamps may also be run from the low-pressure polyphase circuits, being connected either between the three mains in a three-phase system, or preferably between each of the mains and a fourth balance wire running to the junction of the three circuits on the low-pressure side of the static transformer, in which case the latter must be star wound. In a balanced three-phase system the sum of the three currents is always zero, and so a fourth return wire is unnecessary, but where the load may be unevenly distributed, as is the case when lights are run from the mains, a fourth wire will take the unbalanced current and the voltage regulation is more satisfactory than if no return wire were used. As against the extra weight of the return wire this system has the advantage that the voltage between the mains is raised to $\sqrt{3}$ times that required by the lamps, and consequently the mains themselves take less copper. On the other hand, in many cases in practice there is no difficulty in obtaining a good balance even without the complication of a fourth wire. The motors on the circuits act as automatic regulators, for should the voltage between any pair of mains fall owing to extra lamps being switched on to that circuit, the current in the corresponding branch of the motor windings will fall. The back EMF. in these branches will rise and the current still further fall, while at the same time the currents in the other two branches on the motors will rise to make good the deficit, and the voltages will once again become approximately equal. Nevertheless, many engineers prefer the two-phase system with four wires, where, as the two circuits are electrically independent of each other, they can be independently regulated. The lamps are then each on their own circuit, and only in the motors are the two phases brought into play. For this reason it has been suggested that it would be better to employ three-phase transmission in the line on account of the saving of copper (the weight for the same maximum potential difference as compared with the two-phase 4-wire system being in the proportion of 75 to 100) and at the receiving points to transform by static transformers to the two-phase system.

A third method is to transform from three-phase to continuous currents by the use of rotary converters, and much can be said in its favor. In the first place, rotary converters can be made to act not only as transformers, but also as boosters, for the field winding may be compound and sufficient series turns employed to actually make the full load voltage greater than at no load, the phase relations in the polyphase circuit being altered thereby. Again, the periodicity of the polyphase circuits may be too low for the satisfactory working of lamps (neither arc nor incandescent lamps should be worked under 40 revolutions per second), and then the only thing to do is to distribute by continuous currents. Further, the regulation of a continuous current voltage is easy, and, of course, continuous current motors work satisfactorily. Such a combined system is particularly well adapted for traction purposes where, on account of induction troubles and of three-phase currents requiring at least two trolley wires, it is as a rule impossible to use anything but continuous currents for the working of the cars. On the other hand, the use of the polyphase system throughout is in many cases more satisfactory. Where motors alone are to be driven the conversion to continuous current is quite unnecessary; for, as has been said, large motors can be supplied directly from the high pressure mains, and smaller ones only require static transformers in place of the more costly and less efficient rotary converters. Where, however, the distribution is mixed, that is to say, where motors and lights have to be run from the same circuits, the question is not so easy of solution even when the frequency is high enough for lighting purposes. Although in some cases, as has been mentioned, the regulation of voltage on polyphase circuits has been found to be a comparatively simple matter, the experience obtained has perhaps not yet been sufficient for us to say that this will always be the case, and it may be taken as a maxim that wherever regulation will be a difficult matter requiring great care and attention it will be more economical in the end to install some simpler system even at an increased first cost. Again, though accumulators may be charged by means of rectifiers or

rotary transformers from alternating circuits, their use is almost entirely confined to continuous current distribution.

So far as the motors are concerned the polyphase system more than holds its own. Not only will induction motors start under full load, but their regulation is an easy matter. Synchronous motors will run at absolutely constant speed no matter what the load, and well-designed induction motors of from 2 HP. to 100 HP. drop only from 8 per cent. to 4 per cent. in speed at full load. They thus act like continuous-current shunt motors. Their efficiencies between these sizes vary from about 76 per cent. to 92 per cent., and could be designed to be greater still. As a rule, the regulation of speed is effected by a variable ohmic resistance in the rotor circuit, though in cases where large starting torque is not required, auto-transformers, which inductively reduce the voltage of supply, are often employed. Alteration in speed may also be effected by alteration of the number of stator poles, by changing the connections from star to mesh, and by coupling two motors together, so that the rotor current of the first machine supplies the stator of the second. As a rule, however, regulation is effected by altering the resistance of the rotor circuit, though this method has the disadvantage that when carried out to any large extent the efficiency is considerably reduced. The polyphase motor has, further, the great advantage over the continuous-current motor of requiring no commutator. It is also of very strong mechanical construction, and requires little or no attention. Likewise for equal power its weight is less than that of the direct-current machine, while at the same time it can stand very considerable overloading for a short time. There is very little difference in efficiency, power factor, starting torque, and exciting current, between the three-phase and the two-phase motor, what slight difference there is being in favor of the three-phase.

A great deal has been said concerning the low power factor of polyphase systems. For transmissions in which the load consists chiefly of induction motors, the factor varies from 0.65 to 0.85. As a rule it will be about 0.75 or 0.8. The motors and transformers, and not the line, are the chief sources of the lag of current behind the EMF., though the result of a low power factor is increased size of plant all round. The coil can, however, be compensated for to a considerable extent by the employment of a few large synchronous motors, which not only have no lag when properly excited, but when over-excited will still run as motors, with the current leading the EMF. They then in fact act as condensers. One American firm actually sends out condensers with its motors, but generally speaking the condenser cannot yet be regarded as a commercial article. In the matter of power factor the advantage of the three-phase over the two-phase motor is so small as to be practically negligible. It must be remembered that as the load decreases the power factor also decreases, so that when the motor is running light and absorbing but little energy the current it takes is still 20 to 30 per cent. of the full load current.

With the introduction of polyphase motors frequencies have fallen considerably from those of 100 cycles per second, and more, employed some years ago, for electric lighting. The higher the frequency the cheaper are the transformers; but on the other hand, if a motor is to run on a high-frequency circuit at a given speed, it must have an increased number of poles, and this, in small sizes at least, means increased size and cost. Further, the higher the frequency the greater the magnetic leakage and the magnetizing current required. Also, the higher the frequency the greater is the skin effect in conductors, and consequently the more finely must they be subdivided. At Niagara a periodicity of 25 has been adopted, and this is but little lower than that of the majority of polyphase transmissions in America. In Europe a rather higher figure, of somewhere over 40, is more general, in order that the circuits may be employed for lighting as well as for motive purposes.

SUPERHEATED STEAM AND ITS APPLICATION ON STEAM ENGINES.*

BY PAUL SCHOU.

Mr. Schmidt, of Cassel, was the first engineer to introduce a complete plant working with highly superheated steam. The task was a difficult one. Mr. Schmidt was working for fourteen years before he was able to construct a plant to withstand the most severe test. The result has been very striking indeed, and now over 200 complete plants are working satisfactorily in various parts of the world. That superheated steam can also be used for large plants may be gathered from the fact that a 750 HP. compound engine plant has been running now for 3½ years, night and day continuously, without the slightest hitch. The engine is used for a mill rolling fine steel sheets, and the power given off by the engine varies from 400 to 750 HP. The economy has been remarkable, namely, only 8¾ lbs. of steam being used per indicated HP. per hour. The boilers are heated by producer gas, the consumption being equal to 1 lb. of coal per indicated HP. per hour. This result, without doubt, is the best ever obtained on any steam engines in the world. As a proof that this plant has been a success, the existing steam power will be replaced by a Schmidt plant of 4,000 HP.

The economy for smaller plants has also been very remarkable. The writer has made very careful tests on a 70 HP. tandem compound engine, which is driving an ice factory in Ireland, and the steam consumption was 10.2 lbs. per indicated HP. per hour, and the coal consumption 1.4 lbs. per IHP. per hour.

The difficulties which had to be overcome, before making it possible to construct plant to work with highly superheated steam, have been, first of all, to construct the superheater in such a way that the tubes in which the steam is superheated would withstand the high temperature of the gases; and secondly, the proper lubrication of the working parts of the steam engine.

As, however, it is now possible to obtain a mineral oil with a flashing point of 380 to 400 degrees centigrade, the difficulties which were met with many years ago have disappeared. Even with this special oil, the best way of lubricating the gearing for admitting steam into the cylinders and the piston rings had to be devised.

Most of the steam engines, working with highly superheated steam, have been single acting, so as to prevent the piston rings coming into contact with the steam during the admission period. The most interesting type of this kind and the one which has given the best result, is the Schmidt tandem compound engine.

The pistons for the high and low pressure cylinders are made in one piece; the front part of the cylinder forms the receiver, the ring space being the low pressure cylinder. The steam enters the high pressure cylinder, forcing the piston forward; when the piston moves back the steam is led into the receiver. On the next forward stroke the steam passes from the receiver into the low pressure cylinder. Although the high and low pressure cylinders are single acting, the engine is, to a certain extent, double acting, through the novel arrangement of the receiver in which a certain part of the work is performed.

The construction of this engine adapts itself very well to working with steam at high temperatures, for the following reasons:

1. The high pressure cylinders require no steam jackets.
2. The heat taken up by the high pressure cylinder walls during the admission period is not lost, but serves to heat the receiver.
3. The low pressure cylinder is heated by the receiver steam.
4. The high pressure piston is cooled inside by the receiver steam.
5. There is but a single stuffing box, which is only in contact with the receiver steam. The lubrication, therefore, is the same as an ordinary engine. At first sight, it may be said that this engine has one drawback, viz., that the high and low pressure cylinders are only separated from each other so long as the piston rings in the high pressure cylinder keep tight. The difference in pressure between the high and low pressure cylinders is, however, not so great as to make it difficult to keep the piston rings tight, when one considers that when the steam is admitted to the high pressure cylinder, the low pressure cylinder is connected to the receiver and that there is only vacuum in the low pressure cylinder when the high pressure cylinder is connected to the receiver.

There are various other arrangements in compound engines, viz., a single acting high pressure cylinder, and a double acting low pressure cylinder, but of course with all these types of engines, if adopted for very large powers the cost is rather high on account of the superheated steam only working in a single acting cylinder. Schmidt, therefore, has made experiments to use superheated steam in double acting engines, which, however, is only possible after introducing quite a new way of using the steam. This new idea consists in superheating the steam according to the degree of expansion in the cylinder, which is done in the following way: Two steam pipes are led to the cylinder, one coming from the superheater and the other direct from that part of the boiler where saturated steam is produced. The governor on such an engine has two duties to perform, viz., to regulate the degree of expansion and to regulate the temperature of the steam.

To regulate the temperature a valve is fixed in the pipe containing the saturated steam, which is connected by levers to the governor. When working with a very short cut off only superheated steam is admitted to the cylinder, and as the degree of expansion increases the governor opens the regulating valve, allowing a certain amount of saturated steam to mix with the superheated steam, lowering the temperature of same; by this arrangement any temperature required may be easily obtained.

The principal object of this idea is to make it possible to produce a low mean temperature of the cylinder walls, so that steam of high temperatures may be used with safety. In double acting engines, the idea to superheat according to the degree of expansion has been carried still further, by also superheating the steam in the receiver, between the high and low pressure cylinders. All the superheated steam enters through a pipe into the chamber arranged at the end of the receiver. If the engine is working with a short cut-off, the superheated steam passes straight into the high pressure cylinder, but as soon as the degree of expansion increases, a valve which is connected to the governor is lifted, allowing a certain portion of the superheated steam to pass through the receiver coils, passing first into a chamber and returning therefrom, arrives at this point in a saturated condition. It then passes through other parts underneath a valve, mixing with the superheated steam and lowering the temperature of same. The steam passing from the high pressure to the low pressure cylinder through the receiver does not come into contact with the superheated steam.

By this arrangement you will see that on the one hand the more steam is used in the high pressure cylinders, the more steam, of course, will pass through the receiver to the low pressure cylinder; but on the other hand, less superheated steam is required in the high pressure cylinder, and therefore more will be available for heating the steam passing through the receiver to the low pressure cylinder. In other words, it does not matter with what degree of expansion you work, the heat applied to the steam in

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the superheater is always utilized in this arrangement, without loss.

A large plant is now working in Russia, very satisfactorily, constructed on this principle, and although no exact tests have been made, Mr. Schmidt expects the steam consumption to be only 8 lbs. per IHP.

Having now described the steam engine, I will proceed to describe the superheater.

The Schmidt superheater consists of a series of lap-welded wrought-iron tubes, varying in diameter from 1 in. up to 2 in., according to the size of superheater—the coils being welded together in long lengths, so as to prevent any joint coming into contact with the flue gases. The coils are formed in either a spiral or zigzag shape, to suit existing circumstances.

The superheaters may either be arranged in the flue behind the boiler or altogether separate from the boiler plant, the latter type being fired direct, either by coal or gas; either kind of superheater may be attached to any existing boiler.

In the superheater arranged in the flue behind the boiler the steam travels through the superheater coils in the following way: Suppose the gases from the boiler enter the superheater from the top, then the saturated steam from the boiler is led into the superheater through the bottom coil, and travels through one-half of the coils in the opposite direction to the gases, and is then led to the top coil of the superheater, arriving there perfectly dry, but not superheated. The steam then travels in the same direction as the gases, being led off from the superheater at about the middle of the coils. By this arrangement, the coils, which are placed nearest to the gases having the highest temperatures, are cooled inside by the steam preventing the coils from becoming too highly heated. This, of course, is the only way to prevent deterioration for any length of time. Further, all the heat of the gases is utilized as economically as possible.

I should like here to say a few words about the economizer invented by Schmidt, which he arranges behind the superheater, so as to still further reduce the temperature of the gases before same enter the chimney. The principal of this economizer is to work with distilled water in the coils arranged in the flue and passing the distilled water through the feed-water heater. The advantage of this economizer is its great simplicity, it being possible to make the coils in long lengths, as no corrosion takes place inside them, and therefore no cleaning is required. Further, the feed water being heated indirectly by the distilled water passing through the economizer, the temperature of the distilled water returned from the feed-water heater is sufficiently high that the vapor contained in the flue gases coming from the boiler does not condense when coming into contact with economizer coils. The result is that the soot does not adhere to the coils and may be blown off with a small jet of steam in the course of a few minutes, say every week or fortnight, according to the nature of the coal.

The direct fired superheater referred to above is constructed on the same principle; the gases entering the superheater from below and traveling in an upward direction. This type of superheater is specially applicable to cases where a boiler plant already exists, the only alteration required being to lead the steam through the superheater instead of direct from the boiler to the steam engine. Even although extra coal is used for heating the steam, a total saving of 20 to 25 per cent., even on the best compound engine, can be obtained from adopting this kind of superheater.

Before concluding I may say that, especially for steam engines driving large electricity supply stations, there is a great future for the utilization of superheated steam, as the heavy losses which now take place on account of the steam engine having during certain parts of the day to work with only half loads, can be prevented by adopting the Schmidt system, and I hope I have been able to show that the practical difficulties attached to this system have been overcome.

In your own town, Manchester, there will shortly be laid down two boilers, each being connected with a Schmidt superheater—each plant being capable of producing ten thousand pounds of steam per hour. The boilers will be heated by Mond's producer gas, and the steam will drive a 1,000 HP. Raworth engine to be used for electric traction.

SOME REMARKS ON THE PERFORMANCE OF ELECTRICAL APPARATUS ON SHIPBOARD DURING THE LATE WAR WITH SPAIN.*

BY F. W. ROLLER.

In addressing the Society this evening, let me preface my remarks with the statement that much of what I shall have to say is based on hearsay evidence, as is necessarily the case, but the opinions of the numerous other officers with whom I have spoken on the subject seemed to agree so well that I believe you may take the conclusions as generally correct.

In the first place we will divide the electrical appliances that we had into two different classes and compare them.

The first of these will include the indicating apparatus such as the engine room and order telegraphs, speed and direction indicators, helm angle indicators and the range finder. All of these instruments are of the galvanometer type, there being a galvanometer at the receiving end with its scale divided in yards range, degree, revolutions or arbitrary orders instead of volts or amperes, and actuated by differences of potential produced at their terminals from the sending end. They are in consequence delicate in construction and easily get out of adjustment, but they have the advantage of flexibility and possibility of the use of a large number of receiving stations as well as the minor one of requiring inappreciable amounts of energy.

In general it may be said their performance was not satisfactory. In some cases, say that of the range-finder, the trouble cannot be attributed entirely to electrical reasons. In this instrument, where we in reality measure the altitude of a triangle from the known base line (the distance between the two telescopes) and the angles adjacent thereto (those made by the telescopes with the base line when bearing on the target), the base is so very short in comparison to the other two sides that unless the glasses are very carefully trained and the whole apparatus in perfect adjustment a very considerable error will arise. It is easy to see how large this error may be when we know that the glasses could only in the most advantageous cases be placed as far as 300 feet apart, and that the minimum distance from the target that it is likely that they will commence to be used is 3,000 yards; the altitude is here thirty times the base. In addition to this, I understand that the device in several cases proved to be unable to withstand the concussion of the great gun fire. Under the circumstances it is natural that their use should have been largely abandoned, and instead, the secondary battery used. With the great rapidity of fire of this, it was easy to take a large rapid fire gun, load with common shell, estimate the distance by eye, run up the sights for that, and fire. If a hit was made, that was the range; if not, the shell would be seen as it struck the water, the sights readjusted accordingly, and the gun having been reloaded in the meantime, another shot taken. It was rarely necessary to make more than two or three trials of this kind before the range was had to a nicety, and then the main battery could be opened up. But let us return to our subject of the instruments.

They had another feature that contributed to their lack of success, which was the difficulty of locating any derangement that might arise. The men were used only to mechanical devices, and a fault that could neither be seen nor detected by the ear seemed to them most mysterious outside of the fact that the testing, even when understood, was none too simple and was rendered still more difficult by the surrounding conditions. As a consequence, but few troubles made them disgusted, and the instruments got the reputation of being far worse than they were.

There is one other class of electric device that can be said to fall in this first class, in that it employs currents of small strength. This is the electric firing arrangement that was used on some of the rapid fire guns. But few of the ships were fitted with this; the "Nashville" was one, and although we had on the whole the most satisfactory results from it, two or three of the others had, I understand, some trouble from miss fires.

This, however, was undoubtedly due to the low battery power furnished to set off the primers, there being a little case holding three small sized dry cells secured to the gun mounts which were supposed to give all that was required. They did as a rule, but dry batteries are not any too reliable anyway, and standing exposed in a metal case to the intense rays of the sun day in and day out did not tend to help matters any. A more powerful type of cell would undoubtedly render them perfectly certain in their action, and as the breech plugs fitted for electric firing are far more simple mechanically than the other types, there is little doubt but that they will be permanently retained.

Leaving now our first general class, we come to class number two. This includes all appliances requiring considerable amounts of current for their operation and takes in the incandescent lamps, the searchlights and the motors.

It may appear strange that special stress should be laid here to the incandescent lamp, as its advantages seem obvious; but it is of extreme value in many ways that are not so apparent at first glance. If we take the easy control of all the lights from a central point, for instance, here alone is a point of the greatest importance. On a regular man-of-war all of the lights that are out of sight and those necessary for the operation of the guns at night, which are fitted with shields to obscure them, are grouped on a common "battle circuit," so that under war conditions all of the other circuit switches may be opened at sundown with the perfect assurance that after that there will be no glimmer of light to betray the vessel's position. On the auxiliary vessels that we had there was no such provision, with the consequence that in spite of the vigilance of the officers they were bound to be found sooner or later with an unauthorized light going somewhere.

It was easy then to see them at quite a distance, and an enemy's ship would have had a great advantage over them, whether she was chasing or trying to slip by. Another place where the electric light was practically indispensable was for the night signal work.

The regular ships were of course fitted with our standard "Ardois" sets, which consist of a string of five lanterns, each half clear glass and half red. Inside of each were two lamps, either of which could be lit independently, and, by means of a keyboard, the different combinations that formed the signals made. These were always ready, and it was but a second's work to flash the private signal at any craft that was deemed suspicious before betraying your own position too markedly by turning on the searchlight or going further and opening fire. The other ships had to have a number of ordinary lanterns ready lit concealed from observation which they would bend on a pair of signal halliards and hoist when they had a communication to make; an opera-

*Read before the New York Electrical Society, Nov. 14, 1898.

ation requiring considerable time. That this time element was important is illustrated by an incident which came under my observation while on the Havana blockade in the early part of the war. There the captain of one of our auxiliary vessels fired on another one of them one night, fortunately discovering his error before any harm was done, and explained his action the next morning by stating that he only saw the other craft when she was very close to him and thought that she was something trying to get in; that there was "no time for signals where he had all that lantern business to go through, so he fired first and asked questions afterward."

We now come to the second device in our class 2, the searchlight. The value of this was proven beyond all possibility of doubt in this war; not only was it valuable, but I think we can go much further and say that if it had not been for it there is a strong probability that the war would not even yet be over.

We learned afterward that at Santiago, leaving aside the practical certainty of night attacks from the harbor of the enemy's torpedo boats, which would have stood an excellent chance of success, Cervera had fully determined to make a night dash to escape. This was rendered an impossibility by the searchlight beams that were kept on the harbor entrance the night through, which made the place as light as day for the ships that were behind the lights and simply dazzled the eyes of any attempting to get out, rendering the navigation of the tortuous channel exceedingly hazardous, and making shooting practically impossible for them. In consequence he found it on the whole better to make his trial in daylight, with the well-known result. If a night run had been feasible owing to the lack of the searchlight, there is a strong probability that the majority at least of the Spanish ships would have gotten away clear, and if they had succeeded in making Havana their dislodgment and capture of the town would have been a problem of a far different and more difficult nature. An illustration of the power of the searchlight may be of interest. Of course for the purpose of "picking up" an object they are of litle use beyond a distance of two or perhaps three miles, but the light is visible at far greater ranges.

I have more than once when off Havana seen on the clouds the reflection of the searchlight that was mounted on the fort at Key West, a distance of over eighty miles, and not only that, but was able to follow the course of the beam as it swung from side to side.

Anticipating a query to that effect I will say that I do not know of any attempt made to communicate with our vessels by this means.

The last of the power-consuming class, the motors, I have concluded not to enlarge on as you are probably all familiar from reading the papers with their performance. The motors for ammunition hoists, turret training, ventilating, fan driving, and, in some cases, steering gear, gave results so far more satisfactory than any other method of control and operation that their continued use is firmly established. The few failures that occurred were far less in number than those of their steam-driven equivalents, and were even then in most cases traceable more to the lack of familiarity of the men with their apparatus than to any inherent defects of the apparatus. It is needless to go into this any further.

As a result of the foregoing, I think we may fairly conclude that in general the devices that are included in class No. 1 are as at present installed of questionable utility, but that class 2 was an unqualified success and a monument to the engineering ability of our electrical profession.

The Mid-European Motor-Car Club of Berlin is taking active steps to organize an international motor-car exhibition to be held in that city next year. A meeting was held in Berlin recently when a special exhibition committee was elected.

ELECTRICAL TRANSMISSION OF POWER IN MINING.*

The disadvantages attendant upon expensive transport of ore has been to a large extent neutralized by the electrical transmission of power. By using electrically-transmitted power the crushing mills could be placed at the mine, and the serious expense of transporting the ore to the site of the water-power could thus be saved. Generally, electricity furnished the only practicable means for transmitting power for mining operations, and the ease with which a copper wire could be carried over any kind of country, together with the plastic nature of the material, rendered the electrical conductor the simplest and most reliable of all vehicles for power transmission. Before deciding whether power transmission should be adopted, it was generally necessary to compare the cost of the alternative methods of (*a*) bringing fuel to a mine to work the machinery by steam, and (*b*) transmitting power electrically to a mine from a generating station situated at some convenient position for utilizing existing water power. The working expenses, added to the interest on the capital invested, made up in both cases the annual cost; but the question as to which alternative should be adopted depended largely upon the hours of working. For working 12 hours a day a result in favor of steam might be shown, while for a 24 hours' day the evidence might be largely in favor of water, depending upon the capital required to be expended in the hydraulic works.

The plant erected at the Sheba Gold Mining Company's mine for the electrical transmission of power to the crushing mills, five miles distant, was described, and the cost of milling was shown to be 1s. 8d. per ton of ore as against 6s. 1d. per ton when aerial ropeway transport was used, and £1 12s. 6d. per ton during the time of ox-wagon transport. The water power was obtained by a dam across the Queen's River, two miles above the generating station, to which the water was conveyed partly in open race and partly in tunnel. The maximum head derived was 32 ft. The turbines were of the Victor horizontal type, driving a countershaft at 300 revolutions per minute by ropes, and were together capable of developing 396 HP. They were provided with Snow governors, acting directly upon the turbine gate.

The generating plant consisted of three alternating-current dynamos supplying current at 3,300 volts. Each generated two alternating currents having a phase difference of 90 deg., and was capable of giving an output of 150 electrical HP. The armature was stationary, and the field magnets rotated at a speed of 400 revolutions per minute. The stationary high-pressure coils were mounted on laminated iron sectors, which were laid close together in a strong cast-iron cylindrical shell made in halves to form the armature. This was 54 in. in internal diameter by 12 in. wide, and within it the field magnet rotated. Each coil was wound on a former, and had 63 turns of double cotton-covered wire 0.12 in. by 0.09 in. in seven layers. The adjacent layers are carefully insulated by micanite cloth, while the complete coil was boiled in paraffin, and was afterwards heavily covered with impregnated tape to a thickness of $\frac{1}{16}$ in. In addition, during the process of mounting, a trough of fiber was interposed between the coil and the iron core. There were 14 coils on the armature, the seven upper coils being for one phase and the seven lower coils for the other; each therefore contributed about 470 volts to the circuit. The coils were displaced to give the phase-difference by the interposition of idle laminated sectors.

The field magnet was excited by a single coil and consisted of a steel wheel from the rim of which projected two series of poles, N on one side of the coil and S on the other. The poles were expanded on the face, and were curved to form a circle of 16 alternate faces, which were presented to the armature core, with an air-gap of 0.33 in. The exciting coil was wound on a cast-iron drum placed in the middle, between the projecting poles, and was positively driven by a couple of pins screwed into the steel casting. It terminated in a pair of gun-metal rings lying side by side upon, and insulated from, a substantial cast-iron bush, which in turn was keyed upon the shaft. The exciters were ordinary two-pole upright machines. For throwing the alternators into parallel the incoming alternator was plugged on to the synchronizing bars, and when approximate synchronism was indicated by the hot-wire voltmeters it was thrown into the main circuit by closing, through a large choking-coil, a path between the synchronizing bars and the main omnibus bars. The choking-coil prevented a large rush of current, due to difference of phase, between the alternators, though at the same time allowing sufficient current to pass to pull the new machine into step.

The current was transmitted by cables to the mine, and at the receiving house the pressure was reduced to 100 volts for driving motors and lighting the workings. The frequency at which the plant worked was 53.3 per second. The conductors were laid underground, and consisted of concentric cables insulated with impregnated jute covered with lead and armored. There was no fall of potential due to self-induction in the cables, nor had the current in one pair of conductors any inductive effect on the neighboring pair. But when overhead wires were employed, the conductors, being of necessity some distance apart, there was not only a fall of potential due to self induction in the lines, but, unless precautions were taken, the mutual induction of the circuits carrying currents of a quarter-phase displacement tended to produce inductive dissymmetry throughout the system. Every length of cable was tested to a pressure of 10,000 volts before leaving the maker's works. Lightning-guards were fitted at each end of the line, to prevent accidents to the machinery from the effects of the induced charge.

At the receiving-house there were four transformers of 50 kilowatts capacity, two for each phase; these reduced the pressure from 3,000 volts to 100 volts. The use of oil for the transformers had been discarded after the experimental trials. The motors were of the induction type; their construction was fully described, and the author also explained their working under varying conditions, and gave a brief account of the laws which governed their action. The crushing mill at Sheba worked night and day; and in one year, of the possible 365 days of 24 hours each, the pressure had been cut off the conductors for only 4 days 8h. 22 min., which had been chiefly occupied in inspecting the water race, overhauling the belts, ropes, etc., and in executing general repairs to the machinery. The efficiency of the plant from the turbine shafts at the generating station to the motor shafts at the mine might be taken at 70 per cent.

* From the *Electrician*, London. Abstract of paper read before the Institution of Civil Engineers by W. B. Esson.

A Useful Present.

Our thanks are hereby tendered to the Joseph Dixon Crucible Company of Jersey City for a handsome Christmas box containing a large and admirable assortment of the far-famed pencils manufactured by the company. It has been our good fortune to receive annually for a number of years from this company a case of their pencils, and in acknowledging the courtesy it affords us much pleasure to be able to say that the merits of the pencils have kept pace with the years until they have now attained a superiority over other makes that is universally acknowledged. They are graded for all kinds of work and meet all the requirements of a first-class lead pencil.

WIRELESS TELEGRAPHY.

A translation of an article on wireless telegraphy by M. Ducretet, explaining his theory on the subject, has been forwarded to the State Department by W. P. Atweil, commercial agent at Roubaix, and will appear in the Consular Reports. Mr. Atwell says that the experiments spoken of by M. Ducretet are now being carried on at his Paris laboratory. M. Ducretet's article reads in part:

"The starting point was the discovery by Henri Hertz, in 1889, of electric waves analogous to waves of light. A machine invented by him enabled one to perceive the diffusion of electric vibration at a short distance.

"Prof. Popoff, a Russian savant, was on the point of applying this discovery to telegraphy in 1895, when he learned that M. Branly, a Frenchman, had already invented the tube seen in my machine and which is the essential point, as this puts in motion the electric currents, or to use the technical term, the inducting currents.

"M. Branly has not received the proper share of praise for his important invention. In 1890 he had already observed the action of electrical radiation on metal filings, free or agglomerated, placed in an insulator between two conductors forming a circuit made by a battery and a galvanometer. The filings, primitively insulated or of very high electric resistance, become conductors when they are struck by an electric wave. This conductibility is destroyed by a blow, but reasserts itself when the filings are struck by a new wave.

"Experiments have been made in Paris and at Brest, where M. Tissot has successfully communicated with a point 1,800 meters (5,905 feet) distant. I have covered a distance of 4 kilometers (2.48 miles), and the transmission was as clear, even through a fog, as between the Pantheon and my laboratory, rue Claude Bernard. I have reason to believe that still greater distances will be compassed. The chief difficulty will be to find two points at sufficient distance and at the same time high enough not to be hidden from one another.

"In towns posts could be readily established by using windows or towers on high buildings very far apart. The only objection would be that all machines favorably situated would receive the telegrams from one transmitter. This would render telegrams public property unless a secret alphabet were adopted.

"The receiving machine may be utiliz d for other purposes than communicating the current to a telegraphic machine; a row of incandescent lamps can be lighted, for example, or the fuse of a mine touched off. It is merely a question of sufficient force."

"On top of the tall building where M. Ducretet's laboratory is located," writes the consular agent, "is a mast sixty-five feet high, through which a wire passes at the top connected below with an electric conductor, a Ruhmkorff coil and an accumulating battery made after a special plan. The machine is set in motion by pressing a handle. The dispatch arrives as well as if it were connected by a wire between the two points. A bell rings to indicate the transmission of the message, and paper rolls out to receive the words printed by the Morse alphabet. The message is received through a garret window, where a hanging wire communicates with the Morse machine."

Mr. Atwell explains that a smaller transmitter has been constructed which has no mast and no wire running above. A simple wall does not interfere for a space of several hundred meters, but to secure transmission between points at a greater distance there must be no iron walls or shafts between the two points.

Electrical Distribution in Switzerland.

The map showing the distribution of electricity from Les Clus Yverdon system in Switzerland is very interesting to examine, says *Industries and Iron*. There is the very long trunk line which ends at Mont-la-Ville, and the other branch which, starting from the station, goes to L'Aubuson. The power taken from the line by each of the places it passes is marked on the map. There is Champion with 3 kilowatts and Mont-la-Ville 35 kilowatts, and so on.

The force of power is the fall of the river Orbe, a feeder of Lake Neuchatel, a masonry dam being built at the village of Ballaigues. The water is conveyed by a canal for a distance of about two miles to the turbine. The head is 150 ft., the quantity of water 350 cubic feet per second, whilst the output of the station is 1,800 HP. The turbines are of the Picard and Pictet type and the alternators of the Oerlikon. The total length of the primary lines is thirty miles, the voltage is 5,200, which is reduced to 120 at the secondary circuits of the transformers.

Canal Haulage.

We notice in our contemporary, *Cosmos*, says the *Electrical Engineer*, London, that Mr. Galliot, of Dijon, has designed what he calls an electric horse for hauling barges in canals. It is interesting to note the details of the proposed system, because at the end of the article it is compared most favorably with that of Messrs. Thwaites and Cowley. The essential point in the Galliot system is the use of a three-wheel electric vehicle, which is able to absorb about 4 KW. to 6 KW.

This vehicle runs along the canal bank, and is supplied with current from two overhead wires by the side of the towing path. An ordinary towing rope is used between the vehicle and the barge. The author considers that this, in its robust simplicity, is much superior to the Thwaites-Cowley system, but from what we know of the usual condition of canal tow-paths, we are afraid that the vehicle would take almost as much power to propel itself as to pull the barge. Another system is described in the same article, in which a rudder propeller is used on the barge itself. In this case the canal banks are likely to suffer from the backwash set up.

SOCIETY NEWS.

American Institute of Electrical Engineers.

The 129th meeting of the Institute will be held at 12 West 31st street, New York, at 8 o'clock on Wednesday evening, December 28.

A lecture will be delivered by Mr. Arthur A. Hamerschlag on the "Education of Electrical Apprentices and Journeymen." It will be illustrated by lantern slides, but no advance copies will be printed.

Applications received from the following candidates for associate membership will be acted upon by the Executive Committee at its meeting, January 25, 1899:

J. Manley Simpson, St. Paul, Minn.
Royal B. Dagget. Chicago, Ill.
George H. Hill, New York.
Ernest R. Hill, Pittsburg, Pa.
Ernest J. Dyer, Yokohama, Japan.
Wm. A. Lynn, Berkeley, Cal.
Thomas P. Thompson, Brooklyn, N. Y.
Robert M. Wilson, Montreal.
Alfred J. Thompson, Havana, Cuba.

A meeting of Executive Committee will be held at 26 Cortlandt street at 4 P. M. December 28.

Chicago Electrical Association.

At the regular meeting of the Chicago Electrical Association, on December 16, Mr. Arthur Vaughan Abbott, chief engineer of the Chicago Telephone Company, delivered a lecture on "Wireless Telegraphy." His practical demonstrations with working apparatus were enthusiastically received by the large audience. Mr. Abbott has been experimenting and developing his apparatus during the past year and now has established communication between his office and residence, which is two miles distant. In the lecture the principles underlying wireless telegraphy were fully explained, with due credit given to Hertz and other pioneers and later investigators as Marconi.

After the lecture the annual election of officers was held with the following result: President, Thomas G. Grier; vice-president, J. M. Hollister; treasurer, Harold Almert; secretary, Cloyd Marshall; directors: F. S. Hickok, E. W. Jewell and Hayward Cochrane.

Northwestern Electrical Association.

Mr. Thomas R. Mercein, secretary and treasurer of the above Association, has sent us a circular letter in which the announcement is made that the seventh Annual Convention of the Association will be held at Hotel Pfister, Milwaukee, Wis., commencing on Wednesday morning, January 18th, next. The following papers will be read and discussed: "Trend of Central Station Design," by B. J. Arnold, Chicago; "Meter-Rate Systems," by E. L. Debell, Sheboygan, Wis.; "Design of Secondary Circuits in Alternating Plants," by George L. Thayer, Belle Plaine, Iowa; "Electricity Direct from Coal," by Prof. A. J. Rogers, Milwaukee; "Inductive Loads on Alternating Current Transformers," by Prof. D. C. Jackson, Wisconsin University; "Electric Vehicles and Their Relation to Central Stations," by H. M. Maxim, Hartford, Conn.; "Association Management," by H. L. Doherty, Madison, Wis. Mr. Frank L. Perry, Chicago, has kindly consented to give his new and successful illustrated lecture on "Curious Things Electrical," in connection with musical and electrical Indian-club exercises and novel pyrotechnic effects by Mr. George W. Patterson, Chicago.

Mr. Mercein states that he has secured the usual one and one-third fare from the Western Passenger Association, conditioned upon 100 certificates of attendance, which plan was successful last January. Buy railroad ticket one way and get certificate from selling agent. It will be unjust to others to use mileage-books or round trip tickets. The railroad joint agent will be in attendance at the convention all Thursday, January 19th, to countersign certificates. Mr. James Wolff, 320 Dearborn St., Chicago, with Mr. W. W. Low and Mr. George S. Whyte, of that city, will have charge of transportation arrangements for delegates coming from or through Chicago.

The Hotel Pfister makes the usual reduced rates to delegates. Rooms and exhibit space should be secured well in advance. Apply direct to the hotel management therefor, and to Mr. Jacob Cloos, Cawker Building, Milwaukee, for current or wiring needed for exhibits. A banquet, theater parties, sleigh rides, etc., are being arranged for, and enjoyable entertainment for all is assured. It is expected that the coming convention will be the largest and most interesting that the Association has ever held.

Exports of Electrical Material from New York.

The following are the exports of electrical material from the port of New York for the week ending December 24:

Antwerp—15 cases, $1,281.
Australia—683 packages, $12,446.
Berlin—3 packages, $606.
Brazil—131 cases, $2,941.
British West Indies—2 cases, $114.
China—1 case, $35.
Chili—54 cases, $1,059.
Christiana—34 cases, $3,815.
Dutch West Indies—4 cases, $62.
Havre—28 packages, $800; 7 cases, $400.
Hull—3 cases, $363.
Japan—21 cases, $683.
London—236 packages, $9,596.
Longesand—1 case, $28.
Newfoundland—3 cases, $56.
Newcastle—11 cases, $1,400.
Rotterdam—2 cases, $216.
Santo Domingo—9 cases, $153; 1 package, $27.
Southampton—12 cases, $639.
St. Petersburg—4 cases, $336.
Venezuela—19 cases, $216.
Vienna—68 packages, $200.
West Hartlepool—10 packages, $1,060,

LEGAL NOTES.

A jury in the Supreme Court in Brooklyn, N. Y., brought in a verdict on Friday for the defendant in the suit of Herman Schienauer against the Brooklyn Heights road for $10,000 damages for personal injuries in a trolley accident. The Court set a new precedent in such cases by awarding to the defendant, the railway company, in addition to the usual costs, an extra allowance of $500 on account of the difficulty and expense of defending the action.

The Supreme Court of Indiana on the 16th inst. decided that the franchise of the Citizens' Street Railroad Company of Indianapolis expires in 1901, and that the franchise granted by the city to the City Street Railway Company is valid. The effect of this decision, if it shall be sustained, will be to put the City company in immediate possession of certain streets not now occupied by the Citizens' company, and to give the former corporation the right to lay tracks in all the streets now occupied by the Citizens' company on the termination of the latter's franchise in 1901. "It is unfortunate," says the Indianapolis *News*, "that this extremely important decision was made by a divided court. Three judges—Howard, Hackney and McCabe—concurred in the prevailing opinion, while two judges—Monks and Jordan—dissented. It so happens that the case was decided by three judges who are about to retire from the bench. Thus there is no assurance that the decision will stand. If a petition for rehearing is filed, as we suppose it will be, the two judges that now dissent will be likely to consider it favorably. And no one can guess what view the three new judges will take."

A peculiar suit, which was noticed in ELECTRICITY several months ago, was decided in the City Court at Savannah, Ga., on the 17th inst. Twelve years ago the Brush Electric Light Company of Savannah bought in all of its outstanding stock. A new company being formed, the main Brush Company of Cleveland, O., agreed to deliver all of this stock. All but fifty shares were delivered, and a guarantee bond was given for these. Recently these fifty shares were sent to Savannah for the collection of interest, which, with the principal, amounted to about $20,000. The Savannah Brush Company sued for the stock, which was in the possession of George T. Hanchett, of New Jersey, claiming title. Hanchett claimed he had received it for a consideration. It was established that it was transferred to him by his uncle, M. E. Avery, of Cleveland, O., who got it from the parent Brush Company for services rendered. On the ground that it had thus been illegally detained, the jury brought in a verdict in favor of the plaintiff, and the Brush Company at Savannah will get the stock.

In the matter of the insolvency of the Union Traction Company of Bergen County, N. J., Vice-Chancellor Pitney on the 18th inst. rendered a decision in which it is held that the claims of the General Electric Company, which supplied the motors to the trolley company, and the Crocker-Wheeler Company, which supplied the dynamos, should be liens on the property and must be satisfied.

A bill in equity was filed on the 20th inst. in the U. S. Circuit Court at Pittsburg, Pa., by the Thomson-Houston Electric Company of Philadelphia and the General Electric Automobile Company against the Johnson Company and the Steel Motor Company for infringement of patents on certain improvements in switches for electric motors.

Judge Cohen of the Supreme Court has granted an order discharging Arthur Ingraham as receiver of the Electric Railway Company, of No. 1 Broadway, New York. He was appointed receiver in January, 1897. The assets realized $3,914 and the debts proved amount to $29,141.

The Ontario High Court of Justice at Toronto, Can., on the 20th inst., gave judgment against the Government in the suit involving the charter of the Canadian Cataract Company, of which W. Rankine and F. L. Stetson of New York, and Albert D. Shaw of Watertown, N. Y., are members. The Government contended that the company forfeited their charter rights by failing to develop 25,000 HP. at the works and to have ready for use and transmission 10,000 horse power by the 1st of November last, which was one of the conditions specified. The company pointed out that no forfeit or penalty had been mentioned in the agreement for the failure to have the work so far completed by November 1, and based its whole defense on that contention. It won on this technicality.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING.

Alexandria Bay, N. Y.—At a public meeting held here on the 15th inst., it was voted to request the village board to ascertain, as nearly as possible, the cost of an electric light plant, water works and sewerage system, with a view of calling a special election to vote an appropriation to procure them.

Belding, Mich.—The council of this place offers a franchise for electric lighting to any responsible person or company that will agree to put in a plant.

Cleveland, N. Y.—The electric light plant which furnished power and light for the United Glass Company's plant was totally destroyed by fire on the night of the 18th inst. The loss is estimated at $3,000.

Cloquet, Minn.—F. McCormack of Duluth has asked the council for the right to establish an electric lighting plant in this village.

Eau Claire, Wis.—It is announced that the Chippewa Valley Electric Railway Company, which owns the Eau Claire and Chippewa Falls lines and the Interurban, has decided to put in a large power plant. It will bid for the contract for city lighting. The company now uses power furnished by the Eau Claire Light & Power Company.

Green Bay, Wis.—The city council has entered into a contract with the Green Bay Gas & Electric Light Company to furnish light for seven years from May 1, 1899. The contract provides that the city may purchase the plant at any time, the value to be fixed by three experts.

Houston, Tex.—It is rumored that the Houston & Texas Central Railroad Company is figuring on establishing an independent electric light plant in this city for the lighting of its entire yards, offices and buildings. The engineers of the company have been given the necessary instructions in regard to the enterprise and in accordance therewith are now preparing plans and specifications.

Jeffersonville, Ind.—City Attorney Voight has rendered an opinion that the ten-year contract with the Electric Light Company is invalid. This will leave the city at liberty to make a new contract at much lower figures.

Milton, Iowa.—On January 4 the citizens of Milton will vote on the proposition of Keosauqua parties to establish an electric lighting system. The officers of Keosauqua company are: President, S. E Irish; secretary, P. S. Miller; treasurer, S. W. Manning.

Muncie, Ind.—The power house of the electric street light plant, owned by the city, was damaged $3,000 by explosion on the morning of the 16th inst., and Superintendent William Warner will probably lose his life. Mr. Warner was lighting the natural gas fire under a boiler that had not been in use for some time. When the torch was applied there was a terrific explosion caused it is supposed by the accumulation of natural gas under the boiler. The superintendent caught the full force of the explosion and was hurled a great distance through a closed door. The flesh on his hands, arms and face was fairly cooked, and he is internally injured by having inhaled the flames.

Pemberton, N. J.—A contract has been awarded to Walter Sexton to light the borough of Pemberton with electricity.

Provo, Utah.—L. L. Nunn of the Telluride Power & Transmission Company has offered to furnish all apparatus to reduce the current from the main line which belongs to his company to a voltage such as the city can use for lighting at a cost to the city of $1,500, the city to provide a house for said plant, transformer or reducer. All apparatus thus furnished he will take back at the expiration of the contract, if so desired, and refund $1,000, the gross proceeds from the sale of lights to be equally divided, the city bearing all expenses of looking after its line, etc.

Sea Isle City, N. J.—City Clerk Chapman has been instructed by the council to advertise for bids for the lighting of the town with arc and incandescent lights.

Sherman, N. Y.—J. L. Thayer, C. H. Corbett, W. A. Edmunds, T. J. Newell, F. L. Cornish, C. E. Cobb and G. D. Marsh have been elected directors of a company which proposes to erect an electric light plant in Sherman. The authorized stock of the company is $5,000.

Spartanburg, S. C.—Julius L. Carson and others are forming a company here for the purpose of erecting a plant to furnish electric lights and power.

St. Paul, Minn.—Alderman Krauft, having investigated street lighting very thoroughly, says that he has figures to prove that electric lighting, even at $115.50 a lamp per annum, is cheaper than gas or gasoline lighting.

Vineland, N. J.—The citizens' committee has prepared a petition to be signed by property holders, asking the borough council to bond the town in the sum of $140,000 for electric lights, waterworks and other improvements.

Waukegan, Ill.—Mr. Force Bain, the Chicago electrical expert, has made estimates and drawings for an electric lighting system to be established here on the recommendation of the special committee on electric lighting.

West Salem, Wis.—Dr. E. C. Swarthout of La Crosse has entered into a contract with the village authorities to light the streets with sixty 32 CP. incandescent lamps.

STREET RAILWAYS.

Bloomsburg, Pa.—A company composed of New York and local capitalists has been organized for the purpose of pushing the street railway project. The company will take up the franchise granted by the council about a year ago to the defunct Bloomsburg Company. It is the intention of those interested to begin the construction of a line between this city and Berwick at once, and later construct a line southward to Sunbury.

Dayton, O.—It is announced that an important deal is nearing consummation for the consolidation of a number of interurban electric lines including those now in operation and others in progress of construction. The reputed deal includes the Piqua & Troy line, the Dayton & Troy line, preparations for the construction of which have all been completed, and the line which has been established and is in operation between this city and Cincinnati. Such a consolidation would create one of the longest interurban systems in the world, and it is not improbable that others will be drawn into the deal. E. H. McKnight, who is interested in electrical properties in Bowling Green, Troy and Middletown, and who purchased a controlling interest in the Troy-Piqua line recently, says the lines will be equipped with the latest improvements.

Fostoria, O.—The deal with the City Light & Heat Company for the city belt lines has been consummated. Philadelphia parties are interested, and will also acquire the lines of the Northwestern Ohio Natural Gas Company and the property and franchises of the Fostoria Light & Power Company.

Gloucester Court House, Va.—The board of supervisors has voted a subscription of $30,000 to the Richmond & Tidewater Railroad Company if their road is built from Richmond to Gloucester Point. The plan is to build an electric line to carry both freight and passengers, and eventually to extend the line on to Mathews county. At Gloucester Point is deep water, and doubtless an important port would be built up there.

Green Bay, Wis.—It is announced that the Fox River Street Railway will be sold at public auction on the 14th day of January. The order fixing this as the date of the sale has been signed by Judge Hastings.

Greenwich, N. Y.—The company which is to construct the electric railway from Schuylerville to Greenwich has purchased from the National Bank of Greenwich the extensive water power at Middle Falls on the Battenkill. The price paid is understood to have been $10,000. Indications would seem to point to a speedy completion of the road.

Hackensack, N. J.—Senator William Johnson, receiver of the Union Traction Company, has been ordered by the Court of Chancery to sell the roadbed, cars, fixtures, buildings and everything else belonging to that company in Hudson and Bergen counties. The railroad is in operation from North Arlington to Woodridge, a distance of eight miles. The company has secured a right of way as far north as Hackensack, but owing to the demand of this town for $50,000 for right of way, which the company could not pay, it went into a receiver's hands. The Metropolitan Trust Company is the complainant in the foreclosure suit. The date fixed for the sale is January 27.

Hartford, Conn.—A petition to the General Assembly has been filed with the Secretary of State for a charter for the Fairfield & Southport Electric & Water Company. Thomas C. Perkins of Hartford, Jeremiah M. Sheehan of Newburg, and Howard K. Knapp of Bridgeport are incorporators.

Leavenworth, Kan.—A. A. Fenn has been granted a franchise by the board of county commissioners to build an electric railroad from this city to Kansas City, Mo. The road will run along the Leavenworth and Kansas City road to Chelsea park, thence through Kansas City, Kan., and connect with the Metropolitan street car line. This is the third project of the kind to be proposed in the last two years, but Mr. Fenn, it is believed, will push the road through. Freight will be hauled as well as passengers.

New Castle, Ind.—The commissioners of Henry County have granted a franchise to the New Castle Electric Railway Company, consisting of E. B. Phillips, R. Wisehart, Thad. Gordon, D. P. Jennings, Dr. J. F. Thompson and T. B. Millikan. The franchise requires work to begin before October, 1899, and one of the proposed lines finished within six months from that time. Several lines are under contemplation within the county.

Philadelphia.—The Interurban Company has decided to build a trolley road running through Delaware,

Chester and Lancaster counties. The road as planned will run from Philadelphia to Lancaster by way of Willistown Inn, West Chester, Unionville and Quarrytown, to Lancaster, taking in all the small places en route. A branch will connect Oxford and West Chester. The officials of the new company are: President and general manager, Winslow Mason; vice-president, John A. Heaney; secretary, M. E. Gibson; treasurer, Henry C. Hiles; chief engineer, W. T. Forsythe; directors: Thomas Bromley, H. W. Lambirth, S. M. Hess, J. Preston Thomas, Dr. G. Morris Philips, S. W. Smith, M. E. Gibson, C. T. Shields, William Garrett, A. F. Johnson, Charles O. Beaumont, M. S. Way, I. G. Le Fevre, W. Mason and W. M. Franklin.

St. Louis.—Work is about to begin on an important electric railway line connecting St. Louis with the town of Fenton, St. Louis County. The road is to be built by the Fenton & Southwestern Railway Company. The line will be 28 miles long, and run through one of the most prosperous portions of St. Louis County, touching some of the largest fruit and vegetable farms in the State.

Terre Haute, Ind.—An electric street railway line is proposed from Terre Haute west through the cities of Paris, Kansas, Charleston and Mattoon, a distance of fifty-eight miles. Crawford Fairbanks, of Terre Haute, is one of the principal capitalists interested in the proposed line, and with him are associated W. R. Patton, W. J. Kenny and A. J. Fryor of Charleston, and John Hamilton, Joseph Montague and H. S. Clark of Mattoon.

West Chester, Pa.—George F. P. Wanzer is at the head of a company which has just been granted a charter for a proposed electric railway from Pottstown to Phoenixville.

MANUFACTURING, ETC.

New York.—Hon. B. D. Woodward, Assistant Commissioner General of the United States to the Paris Exposition, states that the 218,000 square feet of space already allotted for exhibits from the United States have been taken up, and that demands for space are so many that almost twice the amount could be utilized. In the machinery and electricity groups alone America's request for space already aggregates 300,000 square feet.

Pittsburg, Pa.—Contracts have been let for an extension of the plant of the Westinghouse Electric & Manufacturing Company at East Pittsburg which will require an outlay of about $200,000.

Quincy, Ill.—The Quincy Coal Company has made arrangements to work its mines by electrical machinery and light them by electricity.

Washington, D. C.—The District Appropriation bill carries with it the sum of $60,000 for existing electric arc lighting, necessary inspection, and extension of present lines. The arc lights are to cost not more than 25 cents per night, are to be lighted from fifteen minutes after sunset to 45 minutes before sunrise, and are to be operated wholly by underground wires. For electricians, etc., for telegraph and telephone service the sum of $11,520 is asked; and a similar sum is asked for the purchase of general supplies, including new batteries, poles, tools, insulators, etc.; $6,000 is asked for the purpose of placing wires of fire-alarm telegraph and police telephone service underground in existing conduits.

POWER AND TRANSMISSION PLANTS.

Indianapolis, Ind.—A large power house is now being designed for John H. Murphey, which is intended for small manufacturing concerns that require power and light in limited space. The building will be 90 by 250 feet and will be five stories high, and the cost will be from $40,000 to $45,000. The structure will supply adequate quarters for a large number of small manufacturing concerns.

Pittsburg, Pa.—The Miller Electric Construction Company of this city claim to have a new plan to utilize the power of Niagara Falls, and expect to begin work at the falls in a few weeks. The plan will necessitate the expenditure of about $500,000. It is proposed to erect a large building close to the falls, it being kept in place by anchors and heavy iron cables. With a series of contrivances it is expected to utilize all the force of the falling water. Electrical fluid is to be transported by conduits and heavy wire to distant points.

COMPANY MATTERS.

Akron, O.—The board of appraisers has filed the value of the Akron Street Railway & Illuminating Company on the order of the United States Court. The total valuation is $932,689 63, including $500,000 for franchises. The road is bonded for $1,000,000, and has a floating indebtedness of over $100,000 more. It is expected an order of sale will be issued early in January, when a reorganized company will bid it in. General Sam. Thomas will, it is said, be at head of the new company, which will be capitalized at $2 000,000. The road has been in the hands of a receiver for the past eighteen months, but with its twenty-four miles of track is a paying concern.

Baltimore, Md.—The charter of the Wenstrom Electric Light Company has been sold, but the identity of the purchasers cannot be ascertained. It was learned, however, that the price paid for the charter was $10,000 and that it is the intention of those who have acquired it to form a company to engage in the electric lighting business.—It is understood that the control of the Wenstrom Electric Light Company has been secured by Thomas J. Hayward of the firm of Bartlett, Hayward & Co.

PERSONAL AND MISCELLANEA.

Dwight L Clough, the electrician who was recently reported to have survived a shock from an electric current of 11,000 volts received at the power house of the Buffalo & Lockport Railway, is so far recovered as to be able to tell how it feels to be struck by a strong current of electricity. When a reporter of the Buffalo "News" questioned him in regard to the shock, he said: "Well, in the first place, the report given out that a current of 11,000 volts passed through my body was erroneous. The correct measure of the current was 1,000 amperes under a pressure of between 800 and 900 volts. You see the ampere is the measure of volume while the volt is the measure of pressure. With this correction, however, it remains a fact that the chance of living after such a current goes through one is about one in 100. As to my sensations, I had none. I was filing a brush ring on one of the converters. I stood on a rubber mat to insulate myself, as the machine was running. Unnoticed by me, the mat slipped about, and in changing my position a little, I slipped with one foot into the well under the machine. That threw me against the machine and my foot came in contact with the machine frame, completing the circuit. I saw a blinding flash which seemed to play about my wrists. There was an explosion. I was lifted from the floor an instant and then was hurled back. I was conscious all the time and knew what had happened, but I felt nothing. Apparently every nerve and function of my body except the brain was for the moment paralyzed. I lay for a few moments and then managed to get to my feet and attempted to get to the door, but I seemed unable to control my movements and fell again, this time losing consciousness. The next I knew was when I regained my senses for a time in my room in the hotel." Mr. Clough is badly burned about the hands, arms and ankles.

Dr. Wellington Adams died in St. Louis on the 20th inst. from pneumonia. Dr. Adams was born in Brooklyn, N. Y., and was well known as an electrician and inventor. He believed himself the inventor of the present method of mounting a motor on a single axle in the construction of electric street-cars, and brought suit to establish his claim, but failed. The proposed Chicago-St. Louis electric railway, much talked of at one time, was projected by him. His wife, who was constantly by his bedside during his illness, said to a reporter a day or two before his death: "The doctor in his delirium talks constantly of electricity and of the briefs on a patent case in which he is the attorney. Such an active mind! How pitiful that he should be laid low after the brave struggle he has made against adversity. His time, his heart, his money were devoted to establishing his rights to the patent—on electric power applied to the axle direct—the electric motor—in which contest he fought the electric interests of the country. He lost and the strain has been too great. Worried over his defeat and with his system run down in the recent cold spell he easily caught pneumonia."

Kansas City, Mo., has a street car line that can defy the world to find its equal. It is a modern street railway in every particular, but it is only two blocks in length. One of the strangest features of the line is that it does not run straight, notwithstanding its extremely short length. This miniature road is fitted with the most up-to-date equipment, and is operated precisely in the same manner as any other road. The road is so short that the time occupied in traveling from one terminal to the other is less than one minute. The line is not operated merely to retain the franchise, as might be imagined, but it caters to the accommodation of passengers, just as do roads of greater length, and a great many passengers ride on it during a day. The one car used on the line is a large electric car, equipped with powerful double motors, and is fitted with a stove and all other furnishings common to street cars.

RECENT COMPANY ELECTIONS.

Edison Electric Company, York City, Pa.—President G. P. Yost; vice-president, C. A. Eisenhart; secretary, A. F. Geesey; treasurer, C. C. Frick; directors: the three officers first named and H. S. Wiest, Edward T. Moul, B. S. Gilbert and W. F. B. Stewart.

Fairmount Park Transportation Company, Philadelphia.—President, Charles A. Porter; secretary and treasurer, Ellsworth H. Hults; directors: Charles A. Porter, Robert H. Foederer, Dr. J. H. W. Chestnut, Frederick S Dickson, Dr. L. S. Filbert, Bernard Corr and John B. Peddle.

Irwin Electric Light & Power Company, Irwin, Pa—President, Dr. Charles E. Taylor; secretary and treasurer, J. L. Ridinger; directors: the officers and Edward McGrew, C. F. Bilheimer and A. N. Humphreys.

Pueblo Electric Street Railway Company, Pueblo, Col.—President, M D. Thatcher; general manager, J. F. Vail; vice-president and treasurer, A. McClelland; secretary, J. O. Albert; directors: the officers and C. K. Gast, T. H. Devine, H. C. Levis of Schenectady, N. Y., J. S. Bartlett of Boston, Mass., and Francis Fraser of Denver.

COMMERCIAL PARAGRAPHS.

The Wagner Electric Manufacturing Co. of St. Louis Awarded a Contract for the Largest Transformers in the World.

The Wagner Electric Manufacturing Company of St. Louis, through its manager of sales, Mr. E. H. Abadie, has secured the largest transformer order ever placed in this country. The magnitude of the order itself is not the only surprising condition, but further than this the capacity of the units is 800 horse power larger than any other transformers installed in this country to date. The contract in detail was placed by the Union Carbide Company, for its carbide works at Niagara Falls, N. Y., for seven static transformers of 2 00) horse power output capacity each, and two static transformers of 500 horse power output capacity each, complete with switchboards for operating them.

The transformers are to be of the oil-filled type, with water coils for lowering the temperature of the oil. The contract was closed on definite specifications as to iron and copper losses—full, ¾, ½, ¼, and 1 10 load efficiency, guaranteed as to temperature rise, also as to insulation testing, and guarantees made as to 50 per cent. overload in current. As the electrical apparatus installed by the Union Carbide Company is subject to the approval of the great Niagara Falls Power Company, and as Mr. Stilwell, the managing director, has given his approval of the specifications agreed upon, it will be seen that the Wagner Company is recognized as capable of undertaking and successfully completing any installation that seems feasible in the minds of its engineers, and is to be congratulated on its success in this connection.

By securing this order, the Wagner Company has established a record as builder of the largest power transmission transformers in the world, which, combined with its 40,000 volt High Tension Transformers now operating in Provo, Utah, and Telluride, Colo., places the company in the van as leading the world in the building of the largest single unit transformers, and for the highest voltage, a pre-eminence it has attained in the short period of nine years.

The company we understand is getting some very large orders in high potential transmission transformers, where the units range from 100 to 500 horse power and the high tension voltage as high as 40,000 volts.

The Electric Appliance Company of Chicago are calling particular attention to the Jenkins Switch, which is the latest arrival in the field of snap switches. The Electric Appliance Company claim that they are in a position to sell these switches at a much lower figure than has ever been offered before on a first class article. They solicit an opportunity to quote prices to all users of snap switches.

Considerable has been written lately about an old sign in possession of the Western Society of Engineers at Chicago. The words "Harper's Ferry," painted in black, stand out as boldly as when they were first formed by the artist's brush, while the wood around the letters, which was painted with white paint, has worn away about one-sixteenth of an inch. It is asserted by the writers that no paint manufactured nowadays is equal in durability to that which was applied on the old sign.

Mr. William Hooper, of Ticonderoga, N. Y., does not see anything specially remarkable in the preservation of the old sign and claims that there is just as good a paint made nowadays as then. He adds: "I have seen signs that have been painted with black paint directly on the clapboard of the building. The lettering was good after the paint on the balance of the building had disappeared, and after this the whole building was painted over, lettering and all, and the lettering obliterated; yet in ten years afterwards the old black lettering appeared again quite freshly to view. I suppose the paint for the lettering was made of linseed oil and lampblack. I believe, however, that finely ground graphite mixed with pure linseed oil will last as long, or longer, than any other paint ever known of or used. I had a large iron casting which lay in my mill yard for over thirty years. It was painted with only one coat. The old casting was broken up and sold for old iron last month, and I noticed that the paint on the pieces of casting, even after being broken up, looked quite fresh.

"If the surface to be painted is perfectly dry when the finely ground graphite is applied, the paint will prove the most lasting paint known, because if time eliminates all of the oil, the graphite seems to adhere to the surface painted just the same as a piece of paper or wood will appear after it has been rubbed with a lead pencil or a piece of graphite. No other pigment known to me will remain on the surface painted after the oil has been thoroughly destroyed. With the experience I have had with graphite paint, I thoroughly believe if any dry surface be covered with graphite paint and left untouched for a period of 30 years—by which time the oil will have disappeared—no doubt a letter could be written plainly on the surface by using a piece of large wire or nail after smoothing the end of the wire or nail which is to be used as a pencil. I have done all this and shown it up to others. Writing with the piece of wire polishes the graphite which adheres to the surface, showing that it is there still."

INCORPORATIONS.

The Electropathic Company, Buffalo, N. Y.—to manufacture electrical apparatus. Capital stock, $1,000. Directors: Alfred C. Sheu, Helen Z. M. Rodgers and Elbert Rodgers, Buffalo.

The Municipal Police Signal Company, Chicago—to manufacture electrical signals. Capital stock, $25,C00. Incorporators: John Mackin, N. Banks Cregier and Henry Shafer.

The Briton Power & Electric Company, Briton, S. D. Capital stock, $3,500. Incorporators: Charles Hamilton, Henry L. Stokes, Eugene A. Cooper, George Thiel and Joseph Barber.

The Hamilton & Eaton Electric Street Railway Company, Hamilton, O. Capital stock, $10,000. Incorporators: J. H. Shallenberger, James A. Walker, J. E. Anderson, C. F. Elliott and J. C. Unzicker.

The William Porter's Son Company, New York—to make fixtures for oil, gas and electric illumination. Capital stock, $100,000, all paid in. Incorporators: Annie M. Porter, W. H. Porter and N. E. Porter.

The Leadville Water Works Company, Leadville, Col.—to acquire the property and franchises of the Leadville Water Company, and to erect plants for the generation of electricity and the compression of air. Capital stock, $400,000. Directors: Henry B. Gleaves, D. B. Wesson, W. E. Hawks, C. N. Priddy and W. W. Mason. Branch offices of the company will be established at Boston, Mass., and Portland, Me.

The Electric Indicator Company, Louisville, Ky.—to manufacture and sell electrial appliances, especially the indicator, upon which letters patent were granted to J. D. Keene and J. J. Roberts. Capital stock, $30,000. Incorporators: J. D. Keene, Ben T. Venderink and C. S. Dodson.

ELECTRICAL PATENT RECORD.

Letters Patent Issued December 20, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

616,120. Railway Switch. Edwin S. Leaycraft, Jersey City, N. J. Filed Feb. 3, 1898.
616,301. Pneumatic Motor for Electric Appliances for Cars. Clarence A. Evans, Upland, Pa. Filed July 13, 1897.
616,403. System of Electric Traction. Michelangelo Cattori, Rome, Italy. Filed Dec. 24, 1897.
616,435 Electrically-Welded Joint. Richard Eyre and William Dishong, Johnstown, Pa., assignors, by mesne assignments, to the Lorain Steel Company of Ohio. Filed Feb. 7, 1898.
616,436, 616,437. Electric Welding. Henry F. A. Kleinschmidt, Johnstown, Pa., assignor, by direct and mesne assignments, to the Lorain Steel Company of Ohio. Filed Feb. 7, 1898.
616,102. Car-Fender. Peter Heesem, Pittsburg, Pa. Filed Feb. 17, 1897.

ELECTRIC LIGHTS AND APPLIANCES.

616,111. Arc-Light Regulator. William J. Kelly, Boston, Mass. Filed Jan. 29, 1896. Renewed June 1, 1898.
616,276. Illuminant for Incandescent Electric Lamps and Process of Making. Orlando M. Thowless, Newark, N. J. Filed Jan. 31, 1896.

ELECTRICAL MACHINERY AND APPARATUS.

616,110. Electric Switch. William J. Kelly, Boston, Mass. Filed May 1, 1897.
616,2 5. Field-Magnet for Electric Machines. Sidney H. Short, Cleveland, O. Filed July 28, 1898.
616,313. Electric Generator for Cycles or Other Vehicles. James Moores and Henry O. Farrel, Manchester, England. Filed May 24, 1898.
616,393. Combined Bearing and Power-Transmitting Device. Carl O. C. Billberg, Lewisburg, and Paul A. N. Winand, Philadelphia, Pa. Filed Nov. 23, 1897.
616,405. Automatic Magnetic Circuit-Breaker. Charles M. Clark, New York City. Filed May 27, 1898.
616,417. Indicator. Frederick Hackmann, Milwaukee, Wis., assignor, by direct and mesne assignments, to the Automatic Indicator Company, same place. Filed Nov. 26, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

616,136. Auxiliary Fire-Alarm-Telegraph Apparatus. Bartholomew Oehmen, New York City, assignor to the Gamewell Fire Alarm Telegraph Company, same place. Filed Jan. 14, 1898.
616,186. Microphone Containing Granular Carbon for Retaining Material in Position. Lars M. Ericsson, Stockholm, Sweden, assignor to the Aktiebolaget L. M. Ericsson & Co., same place. Filed April 6, 1898.
616,222. Telegraph-Repeater. Frederick W. Cole, Newton, Mass. Filed Aug. 5, 1893.

MISCELLANEOUS.

616,070. Machine for Measuring Wire and Indicating Its Weight. James P. Barron, John R. Logan and Martin S. Sheridan, Pittsburg, Pa. Filed Oct. 25, 1897.
616,079. Electrical Burglar-Alarm. Clyde Coleman, Chicago, Ill., assignor, by mesne assignments, of two-thirds to George P. Jones, same place. Filed June 29, 1896.
616,082. Thermostatic Auxiliary Fire-Alarm System. Albert H. Cross, New York City, assignor to the Gamewell Auxiliary Fire Alarm Company, Boston, Mass. Filed June 1, 1898.
616,139. Method of Electrolytically Treating Straw or Other Fibrous Material. Goldsbury H. Pond, Ashburnham, Mass. Filed July 9, 1897.
616,148. Magnetic Switch. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed April 23, 1897.
616,165. Carbon for Electric Welding. George W. de Tunzelmann, London, England. Filed Feb 25, 1898.
616,174. Electric Voting Machine. Frank S. Wood, Boston, Mass. Filed Jan. 16, 1897.
616,190. Electric Operation of Elevators by Three-Button Push-Systems. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Brothers & Company, New York City. Filed Dec. 16, 1897.
616,339. Ammeter for Alternating Electric Currents. Waldo A. Layman, St. Louis, Mo. Filed April 4, 1898.
616,358. Electrically-Operated Regulator for Dampers, etc. George F. Richardson, Hartford, Conn. Filed April 15, 1898.

TELEPHONE AND TELEGRAPH.

A bill has been introduced in the U. S. Senate providing a penalty for any failure of the Chesapeake & Potomac Telephone Company to lower its rates as provided by law. The bill recites that not more than $50 per annum shall be charged for a telephone placed in a hotel, store or office or other place of business in the District, and not more than $36 per annum for residences, unlimited service to be furnished in each case. Failure to comply with this law will incur a fine of $500 for each offence. It is further provided that if the Chesapeake & Potomac Telephone Company does not notify the District Commissioners within thirty days from the passage of the act that they will comply with these requirements they are to be prohibited from the use of the streets and avenues of the city for their conduits, and the Commissioners are to dispose of the privilege of operating a telephone service in the District of Columbia to the highest bidder.

Mayor Quincy of Boston has signed the bill granting the Massachusetts Telephone & Telegraph Company the right to construct lines and furnish telephone service in Boston. The company, according to the provisions of the bill, must begin construction by July 1 next and have its lines in operation in two years. The Massachusetts company is associated with the Boston and New York Telephone & Telegraph Company which was incorporated at Trenton, N. J., on the 16th inst., with a stated capital of $1,000,000. The men prominently interested in both of the companies are Zephaniah S. Holbrook, of Cambridge, Mass., who will probably be the president; Oakes Ames, Milton, Mass.; Frederick A. Spear and Charles E. Adams, Lowell, and J. Stewart Rusk, Boston.

The Columbia Telephone Company, of Columbia, Pa., has completed its line to Mt. Joy, where it has secured a large number of subscribers. The lines of the company will soon be extended to Elizabethtown and thence to Lebanon where a local company has been organized. An extension will be also made from Mountville along the pike to connect with the independent company now building a line from Lancaster toward Columbia. The York Telephone Company's line has been erected to within a few miles of Wrightsville. When it reaches the latter place connection will be made with the Columbia company. With York and Lancaster connected by a local company the monopolists will soon see their finish.

It is stated in the St. Louis *Chronicle* that General Manager H. J. Hanford of the Kinloch Telephone Company has just issued the fourth bulletin of the Kinloch telephone system, containing 2,219 names, an increase of 572 over the last issue. Manager Hanford says that the complete directory of the 4,600 telephones now in place in St. Louis will be issued in the early part of January. There are 1,000 other contracts for telephones which the company will soon take up. The company will endeavor to put up and connect 500 'phones a week until the entire system is complete.

Stephen P. Stone, Daniel H. Stone and Charles H. Stone, of Beaver, Pa., and H. C. Patterson, H. H. Patterson and James P. Stone, of Beaver Falls, are the incorporators of the Pennsylvania Telegraph & Telephone Company. It is the intention of the company to consolidate the independent lines operating in New Castle, Youngstown, Butler, Erie and down the Ohio river as far as Wheeling, including Hookstown, East Liverpool, Wellsville and Steubenville.

A conference of the business men of Peoria, Ill., with the Central Union Telephone Company, in regard to a reduction of rates, resulted in a change of schedule lowering the charges on all classes of service from 10 to 35 per cent. The prompt action of the company is attributed to the fact that an independent telephone company has a franchise for the installation of a plant in Peoria, although no work has yet been done, and it is thought that the reduction was made in the hope of scaring the new company out.

The amended sections of the ordinance approved March 31, 1896, by the Philadelphia councils granting permission to the Standard Telephone & Telegraph Company to construct and operate a system of electric wires, conductors and cables through and under the streets of the city, came before the select council at a special meeting held on the 23d inst., and was passed by a vote of 27 yeas to 8 nays. The amendments to the original ordinance are principally such as give the company a longer time in which to get their system into operation, and also permit the placing of wires over and across streets.

A correspondent of the Macon, Ga., *Telegraph*, writing from Lizella, Ga., says: "The Macon & Birmingham Railway has no telegraph line, and as yet no telephone system has been brought into this neighborhood. This would be a fine location for a telephone system connecting us with Macon, and through Macon with the rest of the State. Will not some of the capitalists who read the *Telegraph* take note of this and investigate the opportunity here for profits in this line?"

Congressman Corliss of Michigan has introduced a bill in the House of Representatives providing for a Government cable from some point on the Pacific coast of the United States to Hawaii, the Philippines and Japan. The bill proposes to secure an appropriation from the Treasury to build and equip a cable which would be used for commercial and other messages at rates to be established by the Postmaster-General, who will have charge of it.

The Bell Telephone Company has been endeavoring for some time to get the control of the Western Indiana and the Jasper County telephone companies, which control a large number of exchanges and many miles of toll lines, but at a meeting held at Lafayette, Ind., on the 20th, the Bell proposition was rejected and a 25-year contract was entered into by the above companies with the Lafayette Independent Telephone Company and the new long-distance telephone company of Indianapolis.

The Kansas City, Mo., *Times* of the 20th inst. states that the Standard Telephone Company is now building through Kansas City and will open an office there in a few days. E. Peterson will be the manager. The company has now about 1,000 miles of line and reaches most of the prominent towns in central Missouri. The company expects to reach St. Louis with its lines in about sixty days.

The Perry Electric Company of Peoria, Ill., which is to introduce the automatic telephones in that city has secured its incorporation papers at Springfield. The capital stock is $2,500. The incorporators are Nathaniel V. Perry, Ralph E. Seymour and Dwight R. Chapman of Peoria.

The American District Telegraph Company of Ohio has been incorporated at Columbus with a capital of $50,000, to conduct a messenger service with call boxes and all necessary adjuncts. The company intends to operate throughout the State of Ohio.

The long talked of telephonic communication between the two Russian capitals—Moscow and St. Petersburg—is likely to become an accomplished fact before the end of the year. It will prove an inestimable boon to business men, as telegraph messages require ten or twelve hours for transmission.

Owing to certain alleged irregularities in the ordinance granting the use of the streets and alleys of the borough of Homestead, Pa., to the Homestead Telephone Company, the council of that borough threatens to revoke the franchise recently given the company.

Wm. N. Turner, and Emma B. Turner, his wife, have been granted a telephone franchise by the Common Council of North Vernon, Ind. Long distance connection will be made. Business houses will be charged $1.50 and residences $1.00 per month.

E. H. Rolston, manager of the Hanover telephone system, was at Hopkins, Mo., a few days ago preparing to put in a system which will be owned by a local company. It is expected that a system of seventy-five 'phones will be in operation at Hopkins in a few weeks.

The United Telegraph, Telephone & Electric Company of Chicago has certified to an increase in the number of its directors from five to nine.

At Monroe, N. C., W. S. Lee, J. M. Belk and R. A. Morrow are organizing a company to establish a telephone system.

New Companies Incorporated.

The Columbia & Northern Telephone & Telegraph Company, Colville, Wash. Capital stock, $15,000.

The Pennsylvania Telegraph & Telephone Company, Beaver Falls, Pa. Capital stock, $50,000.

The Youngblood-Stampers Telephone Company, Benton, Ill.—Capital stock, $12,000. Incorporators: R. A. Youngblood, F. H. Stampers and N. H. Youngblood.

The Lexington Telephone Company, Lexington, Tenn.—to operate telephones. Authorized capital, $200,000. Incorporators: J. E. Mcleall, H. E. Gruner, E. J. Timberlake, O. G. Gathing and W. T. Watson.

The Columbus Citizens' Telephone Company, Columbus, O.—to operate a local telephone system. Authorized capital, $500,000. Incorporators: H. D. Critchfield, E. R. Sharp, J. B. Hanna, J. B. Hoge, F. A. Davis, W. A. Hardesty and H. A. Landman.

The Putnam County Telephone Company, Green Castle, Ind.—to operate a plant and line in Putnam and contiguous counties. Capital stock, $10,000. Directors: F. C. Gilmore, C. C. Hart and Jesse Richardson.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Dec 27:						
Albany Ry. Co	100	2,000,000	$1,750,000	1¾ % Q., Aug '98.	150¼	151
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug., 98.	55	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Dec 27:						
Allentown & Lehigh Val. Trac. Co		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Dec 27.						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Dec 27:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98.	...	...
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	81¼	82
Central Ry. Co. of Baltimore City	50	300,000	800,000	6 % A. Dec., 1897.	...	..
Boston, Mass.—Dec 27:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan. 15, '97.	18¼	18¾
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	12	15
North Shore Traction Co.......pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	82¼	...
b West End Street Ry. Co......com	50	10,000,000	9,085,000	3½ % S., Oct., '98.	89½	91
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	110	110⅛
Boston Elevated R. R.	100	10,000,000		2¼ % Aug. 98,	82½	83
Brooklyn N. Y.—Dec 27:						
Brooklyn City & Newtown Ry	100	2,000,000	1,923,400	2 % Feb. 1, 1898.	250	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	76¾	76⅞
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
* dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	239¼	240
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	250	230
Kings County Elevated	....	4,750,000	4,750,000	....	4½	5½
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	48	..
Nassau Electric Railroad.......pfd.	......	6,000,000	6,000,000	....	70	..
fAtlantic Avenue Railroad	50	2,(00,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo, N. Y.—Dec 27:						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	F0	66
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	76¼	78¼
Columbus O.—Dec 27:						
Columbus Street Railroad	100	3,000,000	3,000,000	1 % Q., Aug., '98.	60	65
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Dec 27:						
Charleston City Ry. Co	50	100,000	100,000	3 % S., Jan., '98.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Dec 27:						
Chicago City Ry. Co	100	12,000,000	12,000,000	3 % Q.	295	297
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	13¼	..
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	4
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	3 % Q., Oct., 98.	224	225
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	13,189,000	1½ % Q., Nov. 98	98	...
jChicago West Div. Ry.......guar.		1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Dec 27:						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	..
Cincinnati Inc. Plane Ry.........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	...	80¼
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118¾	119¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1½ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Dec 27:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	40	42
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	†2½	†8¼
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ %., Oct., '98.	82	82½
Detroit, Mich.—Dec 27:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100¼	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Dec 27:						
City Railway Co.............com.	100	1,500,000	1,470,600	1¼ % Q., Jan. 1, '98.	108¼	109
City Railway Co..............pfd.	100	600,000	600,000	1½ % Q., Jan. 1, '98	155	157
People's Street Railway	....	1,100,000	....	....	105	..

*Unlisted. † Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.; $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,-000 stock guaranteed by West Chicago Street Railroad Company, lessee.

l [illegible] Ry. Co. has purchased the Mt. A. & Eden Park road, assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Dec 27:						
Hartford Street Ry. Co	100	$4,000,000	$200,000	8 % S., Jan., '98.	140	–
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	–
Holyoke Mass.—Dec 27:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	185	200
Hoboken, N. J.—Dec 27:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892	105	–
Indianapolis, Ind—Dec 27.						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	23	..
Lancaster, Pa.—Dec 27:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	–
Lancaster & Col. Electric Ry	....	....	87,500	....	..	–
West End Street Railway	...		......	....	..	–
Louisville, Ky.—Dec 27:						
Louisville Ry.................com.	100	4,000,000	3,500,000	1¼ %., Oct., '97.	35	40
Louisville Ry.................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	101	108
Minneapolis, Minn.—Dec 27:						
Twin City Rapid Transit.......com.	100	17,000,000	15,010,000	....	28	31
Twin City Rapid Transit....7 % pfd.	...	8,000,000	1,714,200	1¾ %. Jan., '98.	101	108
Montreal, Canada.—Dec 27:						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	283	284
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	105¾	106⅛
Memphis, Tenn.—Dec 27:						
Memphis Street Railway Co	100	500,000	500,000	....	15	–
New Haven, Conn.—Dec 27:						
Fair Haven & Westville RR	25	1,500,000	900,000	8 % S., Sept. '98.	80	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000	....	..	–
Winchester Avenue RR	25	1,000,000	600,000	....	45	..
New Orleans, La.—Dec 27:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	152	200
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	122	127
New Orleans Traction Co......com.	100	5,000,000	5,000,000	....	2	2¼
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	8½	11
aCrescent City RR............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	18	21
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	..	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	25	27
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	54	58
New York—Dec 27:						
Central Crosstown RR	100	600,000	600,000	2½ % Q	255	260
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	170	..
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98.	180	198
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98.	192¼	192¾
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	83½	84
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	228	..
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	180	185
hEighth Avenue RR	100	1,000,000	1,000,000	....	360	400
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	360	380
jNinth Avenue RR.........guar.	100	800,000	800,000	....	175	180
kSixth Avenue RR...........guar	100	2,000,000	2,000,000	....	200	210
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	385	420
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	181	185
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. '98.	165	168
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	75	80
*Union (Huckleberry) Ry	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Dec 27:						
Consolidated Traction Co. of N. J.	100	15,000,000	15,000,000	....	56	56¼
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Dec 27:						
Allegheny Traction Co	50	500,000	500,000	....	..	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	21¾	21⅞
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %. May, '97.	59½	59¾
pCentral Traction Co	50	1,500,000	‖900,000	1½ % Nov. 7, '98.	..	...
qCitizens' Traction Co	50	8,000,000	‡8,000,000	6 % A.	64	65
rDuquesne Traction Co	50	8,000,000	‡8,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	8½ %, Nov. 7, '98.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	20⅜	27
Pgh., Allegheny & Man. Trac. Co	50	8,000,000	‖2,994,889	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry	25	8,000,000	8,000,000	½ %, Jan., '96.	24⅜	24¾
Pittsburg & West End Ry	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com.	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	800,000	200,000	....	..	..

*Unlisted. ‡ Full paid. ‖ Outstanding. † Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $215,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $8,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock after October,

s Leased to Consolidated Traction Company for 7 % on capital stock after October,

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Dec 27						
Union Street Railway Co	100	$850,000	$850,000	2 %, Feb. '98.	...	150
Northampton, Mass—Dec 27						
Northampton Street Ry	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Dec 27.						
Omaha Street Ry	100	5,000,000	5,000,000	....	25	30
Paterson. N. J.—Dec 27:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Dec 27:						
United Traction & Electric Co	100	8,000,000	8,000,000	¾ %, Jan. '98.	79	80
Philadelphia.—Dec 27:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14½	..
Hestonville, Man. & Fairmount	50	1,966,100	‖1,966,100	2½ %, July 15, '98.	42	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	‡533,900	3 % S—July, '98.	68	..
aFairmount Pk. & Had. Pass. Ry.	50	800,000	800,000	3 % Feb. 1, '98.	66	..
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450	....	32⅛	82¼
cElectric Traction Co	50	....	8,297,920	....		...
dCitizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	330	..
eFrankford & Southwark Pas. R	50	....	‖1,875,000	$14 sha'e A—Apr.98	405	..
fLehigh Avenue Ry. Co	50	1,000,000	....	....	48	...
fLombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
dSecond & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	275	...
ePeople's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	...	..
gGermantown Passenger Ry	50	1,500,000	‖572,800	$5.25 share—1898.	185	188¼
gGreen & Coates Passenger Ry.	50	500,000	‖150,000	3 % Jan., 1898.	185½	..
hPeople's Passenger Ry....com.	25	1,500,000	‖740,000	....	...	...
hPeople's Passenger Ry....pfd.	..	750,000	‖277,402	....	...	...
iPhiladelphia Traction Co	50	30,000,000	‖20,000,000	$2 p. sh., Oct. 98.	94⅝	94⅞
jCatherine & Bainbridge St	50	....	‖400,000	6 % A—Mar., '98.	...	..
jContinental Pass. Ry.....guar.	50	1,000,000	‖580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	‖600,000	....	...	..
jPhiladelphia City Pass. Ry	50	1,000,000	‖475,000	$7.50 share July '98	170	180
jPhiladelphia & Gray's Fy. RR.	50	1,000,000	298,650	$8.50 share July '98	90	..
jRidge Avenue Passenger Ry	50	750,000	‖420,000	$12 share, July '98.	295	300
jPhiladelphia & Darby Ry.guar.	50	....	‖200,000	$2 share July, '98.	...	..
j17th & 19th Sts. Pass. Ry. guar	50	....	‖250,000	1½ % S., July, '98.	157½	..
jThirteenth & 15th Sts. Pass. Ry.	50	1,000,000	‖835,000	$11 sh. A., July, '98	270	..
jUnion Passenger Ry. Co	50	1,500,000	‖900,000	$9.50 shre, July '98	228	..
jWest Philadelphia Pass. Ry	50	750,000	‖750,000	$10 share, July '98	235	250
Rochester, N. Y.—Dec 27:						
Rochester Railway Co	100	5,000,000	5,000,000	....	18	15
Reading, Pa.—Dec 27:						
jReading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
kCity Passenger Ry	50	350,000	850,000	Jan., '98.	114	...
lEast Reading Electric Ry	50	1,000,000	‡1,000,000	Jan., '98.	65	..
St. Louis Mo.—Dec 27:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct., '98.	167	169
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	..	..
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR.	100	2,000,000	1,500,000	4 %, Oct., '98.	..	..
St. Louis RR.	100	2,000,000	2,000,000	2½ %, July, '98.	95	105
Missouri RR.	50	2,400,000	2,300,000	1½ % Oct., '98.	190	193
People's RR. Co	50	1,000,000	800,000	50c., Dec., '89.	..	..
Southern Electric Ry........com.	50	500,000	500,000	....	62	61
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	130	131
St. Louis & Suburban Ry.	100	2,500,000	2,500,000	....	57	58
Union Depot RR.	100	4,000,000	4,000,000	3 % A., July, '95.	125	150
San Francisco, Cal.—Dec.						
California St. Cable RR.	100	1,000,000	600,000	50c. monthly.	109	...
Geary Street Park & Ocean RR.	100	1,000,000	875,000	$2.50 share, '96.	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	55½	56
Presidio & Ferries RR.	100	1,000,000	550,000	....	8½	..
Scranton, Pa—Dec 27:						
Scranton Railway Co	50	6,000,000	2,500,000	....	12½	15
mScranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
mScranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Dec 27:						
Springfield Consolidated Ry	100	750,000	750,000	....	----	..
Springfield O.—Dec 27:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	..
Springfield, Mass.—Dec 27:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	200	207½
Toronto Canada.—Dec 27:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	105¾	105⅛
Montreal Street Railway Co	......	4,000,000	4,000,000	4 % S.	283	284
Washington, D. C.—Dec 27:						
Belt Ry. Co	50	500,000	500,000	....	..	..
Capital Traction Co	100	‡12,000,000	12,000,000	65c. per sh, Oct. 97.	87½	87¾
Columbia Ry. Co	50	400,000	400,000	6 % A.	65	75
Eckington & Soldiers' Home Ry	50	707,000	652,000	....	18	..
Georgetown & Tenallytown Ry	50	200,000	200,000	....	..	..
Metropolitan RR. Co	50	1,000,000	458,900	2½ % Q.	142	145
Worcester, Mass.—Dec 27:						
*Worcester Traction Co.......com.	100	3,000,000	3,000,000		14	16
*Worcester Traction Co......6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	96	98
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Dec 27:						
Wilkesbarre & Wyoming Val. Trac	100	5,000,000	5,000,000	1%, Jan., '97.	24	29

*Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum.
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
f Controlled by Frankford & Southwark Passenger Railway.
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1896-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6½ % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Dec 27:						
American Bell Telephone Co	100	50,000,000	28,650,000	4½ % Q., Oct., '98.	274½	276
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug. '98.	76	77
New England Telephone Co	..	10,894,600	10,804,600	$1.50 %, Aug. '98.	135	..
New York.—Dec 27:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	93½	100
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	108	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	185	190
Franklin Teleg. Co....2½ % guar.	100	1,000,000	......	1¼ % S.	40	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	76	77
*Gold & Stock Teleg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	112	118
*International Ocean Tel Co.guar6%	100	3,000,000	......	1½ % Q.	108	..
Mexican Telephone Co	100	2,000,000	......		..	.80
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	1½ % Q., Oct., '98.	158	..
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000		2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.		
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	90	93
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., July, '98.	112	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	92¾	92⅞
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Dec 27:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	3,168,000	3,168,000	2 % S.	172½	..
Chesapeake & Potomac Telep. Co	100	......	......	....	50	58
Chicago Telephone Co	100	......	......	......	210	..
Central Dist Prtg & Telg.Co.(Pgh.)	100	750,000	750,000	....	182½	184
Empire & Bay States Telegraph Co.	...	......	......	....	75	77
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	75	78
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	112	118
Providence (R. I.) Teleph. Co	50	......	......	....	89½	..
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Dec 27:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25				..	..
†General Electric Co. [old] .. com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new] "	100	18,276,000	18,276,000	......	95½	..
T.-H. Elec. Co..T. Secur., Series D.					2¾	3¼
Westinghouse Elec. & Mfg.Co.com.	50		146,700		88½	89½
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,058	1¾ % Q., Oct., '98.	62	62½
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126			
New York.—Dec 27:						
Edison Elec. Ill'g Co., New York	100	9,188,000	7,988,000	....	185	190
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	2,000,000	1½ % Oct., '98.	..	..
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co		......	......	....	23	30
†General Electric Co. [old]....com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new].... "	100	18,276,000	18,276,000	......	95½	96
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.—Dec 27:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	165	175
East End Electric Light Co	50	800,000	800,000	Q	..	10
Philadelphia, Pa.—Dec 27:						
Edison Electric Light Co	100	2,000,000	......	......	144½	
*Electric Storage Battery Co..com.	100	8,500,000	......	......	58¾	59¼
*Electric Storage Battery Co...pfd.	100	5,000,000		....	65½	66½
‡ Kings Co. El. L. & P. Co	100	2,500,000	2,500,000	A. & O.	..	151
*Penna. Ht., Lt. & Pow. Co....com.	50	5,000,000	.. ...	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co	10	550,000	550,000	$82500 dis. Jan.11'97	18¾	14
Southern Elec. Light & Power Co	10	187,500	187,500	....	18¼	..
Miscellaneous.—Dec 27:						
Brush Electric Co	50	......	......	......	..	..
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	41	45
Missouri-Edison (St. Louis)....com.	..	......	......	....	21½	23½
Eddy Electric Mfg. Co	25	......	......	....	----	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	....	125	..
Hartford (Conn.) Lt. & Power Co.	25	175,000	......	....	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	....	177	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	84	..
Rhode Island Elec. Protec. Co	100	......	......	....	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	.....	2% Q	‡162½	163½
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	189⅝	140
Thomson-Houston Welding Co	100	......	......	8 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	. ....	......	....	100	..

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,200. of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Dec 27:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh. Nov.16, '98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	92	100
New York.—Dec 27:						
Consolidated Electric Storage Co	...	......	....	....	9½	16
Edison European	..	......	....	......	..	...
Safety Car Heating & Lighting Co	100	......	....	......	104	...
Worthington Pump Co........com.	100	5,500,000	5,500,000	......	85	40
Worthington Pump Co..........pfd	100	2,000,000	2,000,000	7 %	100	102
Philadelphia, Pa.—Dec 27:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	--
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	..	..
Welsbach Commercial Co.....com.	100	8,500,000	......	....	10	15
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	62	65
Welsbach Light Co	5	525,100	......	....	39	40
Welsbach Light Co., Canada.	5	500,000	......	....	..	2½
Pittsburg, Pa.—Dec 27:						
Carborundum Mfg. Co	100	200,000	200,000	....	..	--
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	115	119
Miscellaneous.—Dec 27:						
*Barney & Smith Car Co.......com.	100	......	1,000,000	....	14	16
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	69	70½
Billings & Spencer Co	25	......	....	....	80	86
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	37	45
Johns-Pratt Co	100	......	....	....	90	100
*Pratt & Whitney Co..........com.	100	......	....	....	4½	8
*Pratt & Whitney Co...........pfd	100	......	....	....	45	47
Stillwell-Bierce Co............com.	..	......	....	....	..	...
Stillwell-Bierce Co...............pfd.	..	......	......	2 % Sept. 1, '98.	96	98
Shultz Belting Co	100	500,000	......	....	82	87
St. Charles Car Co	--	------	------	----	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Albany, N. Y.						
Date of Quotation—Dec 27, 1898						
The Albany Ry...............1st mtg. 5s.	....	$29,000	1905	....	.....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*115½	......
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*114	115
‡Watervleit Turnpike & RR.1st mtg. 6s	350,000	350,000	1919	M. & N.	*120	....
‖Watervleit Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*116	....
Troy City Railway Co..................1st 5s	....	....	......	......	*106½	......
‡Interest guar. by Albany Ry. Co. ‖Principal and interest guar. by Albany Ry. Co.						
Baltimore Md.						
Date of Quotation—Dec 27, 1898						
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113	114
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	116	116⅛
Baltimore Trac. Co..Exten. & Imp. g. 6s,	1,250,000	1,250,000	1901	M. & S.	103	104
Bal. Trac. Co..No. Balto div.1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	117	118
†Bal. Trac. Co. Coll. Trust,1st mtg. g. 5s.	750,000	....	1900	J. & J.	......	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co...........1st mtg. 6s.	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s.	601,000	580,000	1932	M. & N.	115	116
City & Suburban Ry......1st mtg. g. 5s.	3,000,000	3,000,000	1922	J. & D.	116	.....
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113½
Metropolitan Ry. (Wash.).1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	120¾	......
†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co. ‡$151,000 in escrow to retire 1st.mtg.bds.						
Boston, Mass.						
Date of Quotation—Dec 27, 1898.						
†Lynn & Boston RR.......1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	107¼	108½
West End Street Ry........Deben. g. 5s.	8,000,000	3,000,000	1902	M.& N.	105	105¼
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	....
†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.						
Charleston S. C.						
Date of Quotation—Dec 27, 1898.						
†Enterprise Street RR........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	....
†Charleston City Ry...........1st mtg. 6s.	850,000	....	....	J. & J.	....	....
†Controlled by Charleston St. Ry .Co.						
Chicago Ill.						
Date of Quotation—Dec 27, 1898.						
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¾	103
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T.............4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s,	4,040,000	4,040,000	1932	J. & J.	105½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	64½	......
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¾	......
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	....	......
North Chicago City Ry.......1st mtg. 6s.	500,000	500,000	1900	J. & J.	101½	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	106½	107
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	103½	......
West Chicago St. RR........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	......
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	96	96¼
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....
†Redeemable at option on 60 da. notice. ‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee. ¶Subject to call after Oct. 1, 1899, at $110 and interest. ‖Assumed by W. Chi. RR. Co., lessee. §Int. guar. by W. Chicago St. RR. Co.						
Cincinnati, O.						
Date of Quotation—Dec 27, 1898						
Cin. New. & Cov.St. Ry.1st Con.mtg. g.5s	3,000,000	2,500,000	1922	J. & J.	106	106¼
'Mt. Adams & Eden P'k In..1st mtg. 6s.	46,000	46,000	1900	A. & O.	103½	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	112¾
†Mt. Adams & Eden P'k Inc.Cons.mtg.5s	531,000	531,000	1906	M. & S.	108	......
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119¼	......
‖So. Cov. & Cin. St. Ry........2d mtg. 6s.	400,000	400,000	1932	J. & J.	131	134
†Assumed by the Cincin. St. Ry. Co. ‖$250,000 reserved to retire 1st mtg. bds.						
Cleveland, O.						
Date of Quotation—Dec 27, 1898.						
*a*Brooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1903	M. & S.	105½	106
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	3,000,000	2,500,000	1922	J. & J.	106	106¼
Cleveland City Cable Ry....1st. mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105½	106
†Cleveland Electric Ry.Co. 1st mtg. g. 5s.	3,500,000	1,249,000	1913	M. & S.	103½	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
*a*East Cleveland RR..........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	107	108
Ft. Wayne (Ind.) Elec. Ry.1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s.	600,000	600,000	1912	J. & D.	....	....
†$1,900,000 in escrow to retire bonds of absorbed companies, marked *a*. ‡Interest guar. by Cons. St. Ry. Co.						
Detroit, Mich.						
Date of Quotation—Dec 27, 1898.						
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	3,835,000	1905	A. & O.	98½	100
Ft. Wayne & Belle Isle Ry...1st mtg. 6s.	400,000	377,000	1902	A. & O.	....	....
The Detroit Ry...............1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	100	105
†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.						
New Haven Conn.						
Date of Quotation—Dec 27, 1898.						
New Haven St. Ry.........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	108	......
New Haven (Edgewood Div.)1st mtg.5s.	250,000	250,000	1914	J. & D.	107	....
Winchester Avenue RR....1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 6	100,000	94,00[illegible]	1908	M. & S.	102	......

*With interest. *Unlisted.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Orleans La.						
Date of Quotation—Dec 27, 1898.						
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	108	......
Crescent City RR..........1st mtg. 6s.	......	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83⅞	84¼
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	104¼
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	107¼	108¾
N. Orleans & Carrollton RR.2d mtg. 6s.	350,000	350,000	1907	F. & A.	111	....
Orleans Railroad Co.......Cons. mtg. 6s.	300,000	300,000	1912	J. & J.	89	....
‡St. Charles St. RR. Co.......1st. mtg. 6s.	300,000	75,000	1906	J. & D.	106	.....
†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds. ‡$90,000 outstanding.						
New York.						
Date of Quotation—Dec 27, 1898.						
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn).1st gen. mtg.5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	110	111
‡Bro'dway & 7th Ave.1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122½	123½
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave..........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface..........1st mtg. 5s.	1,125,000	1,125,000	1924	......	116	119
Broadway Surface..........2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116	118
Brooklyn City & Newtown...1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	115
¶Brooklyn,Bath & W.E. RR.Gen.mtg.5s.	1,000,000	448,000	1933	J. & J.	90	....
Brooklyn Heights RR......1st. mtg.5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	110½	112
Brooklyn, Q's Co.& Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	103½	105½
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	107	......
Bleecker St.& Fult'n Fer'y RR.1st mtg.7s	700,000	700,000	1900	....	103	105
Cent P'k, N.& E. R. RR.1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111¼	113
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	120
Coney Island & Brooklyn RR.1st mtg.5s	300,000	300,000	1903	J. & J.	102	104
§D. Dock,E. Bd'y & Bat'y R.gen.mtg.g.5s	1,000,000	930,000	1932	J. & D.	115	117
Dry Dock, E. Bd'y & Bat'y RR..scrip 5%.	1,100,000	1,100,000	1914	F. & A.	101	103½
Eighth Av. RR. Co......Cert. indebt. 6%.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115½	117½
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	98	99
Lex. Ave. & Pav. Ferry RR.1st mtg. g.5s.	5,000,000	5,000,000	1993	M. & S.	124¾	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1°,500,000	1997	F. & A.	118	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	117½	118
Second Avenue Ry.............Deb. 5s.	300,000	300,000	1909	J. & J.		
Steinway Ry. (L. I.)........1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	113	115½
South Ferry RR. Co.........1st mtg. 5s.	350,000	350,000	1919	......	110	114
Third Avenue RR...........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	128	......
Twenty-third Street Ry.......1st mtg. 6s.	....	....	1909	J. & J.	....	....
Twenty-third Street Ry...........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	114½	116
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112½
†$1,035,000 in escrow to retire gen. mtg. bonds. ‡$4,850,000 in escrow to retire maturing obligations. ¶$552,000 in escrow to retire 1st and 2d mtg. bonds. §In treasury, $80,000. ‡‡ Guar. by Union Ry. Co.						
Toronto Canada.						
Date of Quotation—Dec 27, 1898.						
Montreal St. Ry..............1st mtg. 5s.	2,500,000	300,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....
†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.						
Philadelphia.						
Date of Quotation Dec 27, 1898.						
Continental Pass. Ry...........1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry...........1st mtg. 7s	300,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	......	....	....
People's Pass. Ry...........1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry............2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry...........Cons. mtg. 5s	1,125,000	367,000	1912	M. & S.	....	....
People's Pass. Ry......Stk. trs. cert. g. 4s	5,698,210	......	1943		105½	105¾
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	.....	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry.......1st mtg. 7s	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry..........1st mtg. 5s	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...........Col. tr. 4s	29,735,000	29,724,876	1945	A. & O.	....	....
West End Passenger Ry...........1st mtg. 7s	....	......	1905		....	....
West Phila. Pass. Ry.........1st mtg. g. 6s	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry...........2d mtg. 5s	750,000	750,000	1926	M. & N.	116	116¼
§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.						
Pittsburg, Pa.						
Date of Quotation—Dec 27, 1898.						
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	......	......
Central Traction Co..........1st mtg. 5s.	875,000	375,000	1930	J. & J	111	......
Citizens' Traction Co........1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	......	......
*Duquesne Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	114	......
*Fed'l St. & Pleas. Val. Jack's Run......5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley.......Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	......
Millvale, Etna & Sharpsburg..........5s.	750,000	750,000	1928	M. & N.	108½	......
Pittsburg, Crafton & Mansfield..........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co.........1st mtg. 5s.	750,000	750,000	1927	A. & O.	......	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	108½*	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.	.....	......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	.....	......
Second Ave. Traction Co..................5s.	2,500,000	2,000,000	1934	J. & D.	......	......
Sub. Rapid Transit Railway Co.........6s.	500,000	500,000	1918	M. & S.	......	......
Providence R. I.						
Date of Quotation—Dec 27, 1898.						
Newport Street Ry.................Coupon 5s	50,000	50,000	1910	J. & D.	......	......
United Trac. & Elec. Co....1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	108½	110
St. Louis.						
Date of Quotation—Dec 27, 1898.						
†Baden & St. Louis RR.........1st mtg. 5s.	250,000	250,000	1913	J. & J.	101	103
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co..............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter...1st 5s	[illegible]	[illegible]	1913	J. & J.	113	115

*With interest.

PASSENGER RAILWAY.

St. Louis.

Date of Quotation—Dec 27. 1898.

Name.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Jefferson Avenue Ry............1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co........................1st mtg. 5s	1,500,000	1,500.000	1911	F. & A.	108⅛	110½
Missouri RR. Co....	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co..............1st mtg. 6s.	400,000	300,000	1910	A. & O.	101	103
People's RR. Co......................1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co.....................2d mtg. 7s.	75,000	75,000	1902	M. & N.	97⅛	100
People's RR. Co.................Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co......................1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	100⅛	101⅛
§St. Louis & Sub. Ry.........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	105	107
St. Louis & Sub. Ry................Income 5s.	800,000	800,000	......	....	65	70
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
¶Taylor Avenue St. Ry......1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	113½	115
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102⅛	103⅛
Union Depot RR. Co.........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	116⅛	117½

†Controlled by St. Louis RR. Co.
‡Controlled by Union Depot RR. Co.
¶Controlled by Lindell RR. Co.
‖$200,000 in escrow to retire 1st & 2d mtg.
§$600,000 in escrow.
††$200,000 in escrow to retire 1st mtg. bds.

San Francisco Cal.

Date of Quotation—Dec, 1898.

Name.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	115⅛	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	114⅛	......
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	......	100
Market St. Cable Ry. Co.....1st mtg. g. 6s.	3,000,000	3,000,000	1918	J. & J.	128⅛	129
†Metropolitan Ry. Co.................1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co...............1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126	......
†Park & Cliff House RR.......1st mtg. 6s.	350,000	350,000	1912	J. & J.	106⅛	108⅛
†Park & Ocean RR................1st mtg. 6s.	250,000	250 000	1914	J. & J.	112	......
†Powell St. Ry.......................1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	123
Sutter St. Ry. Co..............1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......

†Controlled by Market St. Ry. Co.

Washington D. C.

Date of Quotation—Dec 27, 1898.

Name.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Belt Ry. Co.........................Cons mtg 5s.	500,000	450,000	1920	J. & J.	51	....
Columbia Ry..........................'s mtg. 6s.	500,000	500,000	1914	A. & O.	118	125
Eckington & Soldiers' Home mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	128	......

†$50,000 in escrow to retire 1st mtg. bds.

Miscellaneous.

Date of Quotation—Dec 27. 1898.

Name.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,688,000	1923	J. & J.	103	......
Buffalo (N. Y.) Ry. Co......Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	112⅛	114
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	79	80
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	111⅛	112½
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	103	105
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	109	......
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	102	102½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co......Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,981,000	1930	J. & J.	116	117
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	100	102
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	3,000,000	2,878,000	1928	J. & J.	104	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	489,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg. g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry............1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	105	......
St. Paul City Ry...................Cons. g. 5s.	5,500,000	4,298,000	1937	......	.....	......
St. Paul City Ry......................Deb. g. 6s.	1,000,000	1,000,000	1900	......	......	....

†$1,000,000 in escrow to retire 1st and d mtg. bds.
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.
¶$760,000 in escrow to retire bonds of C. C. St. RR. Co.
‖$87,000 in treasury.
§$960,000 res'ved to redeem prior liens.
††$620,000 in escrow.

*With int'rest

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

Boston, Mass.

Date of Quotation—Dec 27, 1898.

Name.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Edison Elec. Illuminating Co., Boston....	2,026,000	......		Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	108	......

Pittsburg Pa

Date of Quotation—Dec 27, 1898

Name.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Allegheny County Light Co...............6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light............4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	....	......

Miscellaneous.—(Dec 27, 1898.)

Name.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,812,000	4,812,000	1910	......	111⅛	112
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	122	.
Edison Elec. Illg. Co. (Brooklyn)........	2,500,000	1,500,000	1940	....	110	115
Edison Electric Light (Philadelphia)..	2,000,000	......	...	.....	....	......
Edison Illg. Co. (St. Louis)...............	4,000,000	......	1923	F. & A.	....	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	....
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000.000	......	....	......	....	....

TELEPHONE AND TELEGRAPH.

Miscellaneous.

Date of Quotation—Dec 27. 1898.

Name.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
American Bell Telephone......................7s.			1898	F. & A.	102	....
Northwestern Telegraph Co................7s.	....	......	......	......	....	......
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	106	......
Chesapeake & Potomac Teleph. Co...5s.	....	......	1911	J. & D.	108	....

ALLIED INDUSTRIES.

Miscellaneous.

Date of Quotation—Dec 27, 1898.

Name.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
American Electric Heating..............5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co..................	....	....	......	......	......	25
Barney & Smith Car Co....................†6s	....	......	1942	J. & J.	97	100
Carborundum Mfg. Co.....................5s.	....	....	1904	M. & S.	....	....
Worthington Pump Co	[illegible]	......	......	......	......	....

*Unlisted †Nominal

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12.65@12.75c.; Lake, 12.75@13c.; casting, 12.65@12.75c.

The Electrozone Commercial Company of Philadelphia will, it is stated, erect a plant at Atlantic City with a capacity of 10,000 gallons a day.

The American Bell Telephone Company has declared its regular quarterly dividend of 3 per cent. and an extra dividend of 1½ per cent., payable January 16. Books close January 2 and reopen January 14.

The Boston Electric Light Company has declared a quarterly dividend of $1.50 per share, payable January 14 to stock of record December 31, 1898. Transfer books will be closed from December 31 to January 14.

The Thirteenth & Fifteenth Streets Passenger Railway Company Philadelphia, has authorized the distribution of six months' rental under lease to the Philadelphia Traction Company, being $5.50 per share, payable January 3.

The City Passenger Railway Company of Baltimore has declared its regular quarterly semi-annual dividend of 5 per cent. The Consolidated Company of Baltimore declared 2½ per cent. dividend for the half year, an increase of ½ per cent., and places the stock on a 5 per cent. basis.

By a recent transaction the first mortgage bondholders of the Saratoga (N. Y.) Traction Company have come into possession of a majority of the stock and the bondholders and stockholders are now virtually the same parties. It is their intention to extend the road to Ballston Spa, and have it in operation by next July.

The Kings County Electric Light & Power Company gives notice to stockholders of the Edison Electric Illuminating Company of Brooklyn that the Central Trust Company will be ready December 28 to issue temporary certificates calling for the 6 per cent. 99-year gold bonds which are to be issued in exchange for the Edison stock deposited.

The New York Rapid Transit Commissioners have prepared a new bill to submit to the Legislature, one section of which will give it the right to dispose of surplus electricity as heat, light and power, not only along the route of the proposed underground road, but also into all parts of the city which can be conveniently reached by subways leading into the tunnel.

A. J. Elias, Henry Hart and other heavy shareholders in the Third Avenue Railroad, New York, have purchased the Fifth Avenue stage line, the last remaining relic of omnibus transportation in this city. It is understood that the line will be equipped with electric stages, the Third Avenue people having considered this a favorable method of using their surplus electricity.

The Philadelphia "Stockholder" says it is understood that negotiations are in progress looking to the establishment of a considerable plant and a reorganization of the management of the American Railway Electric Light Company. The additional intimation is current that a consolidation of all the railway lighting concerns in the country is probable in the near future.

The Brooklyn "Eagle" publishes the report that there is to be a readjustment of the securities of the Brooklyn City Railroad shortly after the first of the year by converting its stock and bonds into 4 per cent. bonds. There are $12,000,000 of the stock of the Brooklyn City Railroad upon which dividends of $1,200,000 are annually distributed. In round figures there are $7,000,000 of bonds on which the interest at the rate of 5 per cent. per annum amounts to $350,000 or a total of $1,550,000 annually. To convert these into 4 per cent. bonds would require an issue of $38,750,000.

The "Railroad Gazette" publishes in its last number some figures of the cost of operating street railroads in New York and Chicago, from a paper read at Stevens Institute by Arthur J. Wood. While the electric conduit roads are operated in New York at a cost of 10.23 cents a car mile, in Chicago the cost of trolley roads is 13.051 cents. The cable roads in New York cost 16.35 cents a car mile to run, while in Chicago the cost is only 10.706 cents. In Connecticut nineteen trolley roads, each of which carries more than 1,000,000 passengers a year, show an average working cost per car mile of 13.83 cents.

The Philadelphia "Inquirer" of the 24th inst. says: "A corporation with a capital of $25,000,000 is in process of organization, and will shortly apply for a charter under the laws of New Jersey, which has for its object the combination of the electric light companies in Camden, Atlantic City and other points in New Jersey, and also places in Delaware, Montgomery and Chester counties in Pennsylvania. Philadelphia capitalists will be largely interested in the company, and negotiations are now being made with companies in the places where it is proposed to do business, with the view to securing the lighting privileges. There will be 500,000 shares of the new company's stock, par value $50. It is denied that 100,000 of these shares will go as a bonus to the stockholders of the Pennsylvania Manufacturing, Light & Power Company."

The following order has been sent by the Secretary of War to the commanding officers in Cuba, Porto Rico and the Philippines: "Until otherwise ordered, no grant or concessions of public or corporate rights or franchises for the construction of public or quasi-public works, such as railroads, tramways, telegraph and telephone lines, waterworks, gas works, electric light lines, etc., shall be made by any municipal or other local governmental authority or body in Cuba, Porto Rico or the Philippines, except upon approval of the Major General commanding the military forces of the United States in Cuba, Porto Rico or the Philippines, who shall before approving any such grant or concession be specially authorized by the Secretary of War."

The following appears as a New York item in the Boston "News Bureau" of the 22d inst.: "We learn upon undoubted authority that the New York Gas, Electric Light, Heat & Power Company has secured control of the Edison Electric Illuminating Company of New York. The former company is controlled by the Whitney syndicate in the interest of the Metropolitan Street Railway and will use its surplus electric power. The stock of the Edison Company will be taken in on a basis of about 210 in exchange for a 4 per cent. bond. The issue of bonds has been underwritten and will be offered to the public within the next fortnight. The subscription price has not been determined but will not be under par. This insures something more than 8 per cent. on the Edison stock."

Mr. E. E. Higgins, editor of the "Street Railway Journal," in a recent interview with a representative of the New York "Commercial," gave the following interesting information in regard to the operations of the principal street railway companies, showing a gratifying increase in the general business. He says: "In 1897 the gross results were but 1 9 per cent. more than in 1896, which improvement was materially less than that of 1896 over 1895. In 1898, however, the improvement has again become decided, as is shown by the following figures: In New York City the Metropolitan Street Railway Company shows 24.8 per cent. gain in the last nine months of the year, in Brooklyn the Brooklyn Rapid Transit system shows 12 8 per cent. gain, and the Nassau system 14 2, while the elevated lines in that city have to record a loss. In Albany the gain is 8 6 per cent., in Syracuse 5 9 per cent., in Providence 2 8 per cent., in Boston (North Shore Traction Company) 3.6 per cent., in the shoe manufacturing city of Brookline 1.3 per cent., in Baltimore (Consolidated system) 1 6 per cent., in Scranton 6.1 per cent., in Cleveland (Cleveland Electric) 5.1 per cent., in Columbus 12 8 per cent., in Detroit (Detroit Citizens') 8.4 per cent., in Chicago (North Chicago) 3.9 per cent., in Minneapolis (St. Paul) 8 per cent., in New Orleans (New Orleans Traction) 5.6 per cent., in Kansas City 1.07 per cent., and in Denver 4 per cent."

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CONTENTS.

EDITORIAL NOTES.

American Methods and Electrical Apparatus Abroad.

The British manufacturer would seem to be gradually awakening to the fact that during the last decade this country has been making very rapid strides in the manufacture and use of electrical machinery and distancing Great Britain, which, with its proverbial conservatism, was slow to adopt electricity as a motive power. Strenuous efforts are now apparently being made by men of high standing in England to spur on the manufacturers of electrical apparatus in that country with a view to cutting down if possible the lead this country has of them. It is naturally exceedingly aggravating, and goes against the average Englishman's pride, to be obliged to purchase yearly a large amount of electrical apparatus from us, and even be obliged in some cases to send over here for electrical engineers and skilled laborers.

Mr. E. V. Knox, a member of the British Parliament, in a recent communication to the London *Mail*, stated that during the past ten years the people of the United States, by a liberal policy pursued towards street railway companies in granting them franchises over streets, had created an industry almost as great as Great Britain's trade with China, which the British have been building up little by little for the last forty years. Among other things in the communication referred to, Mr. Knox stated that in the last few years 12,000 miles of electric street railways had been constructed in the United States at a cost, including equipment, of $300,000,000.

The mileage given is, however, not strictly accurate, as this country at the present time has approximately 14,000 miles of electric street railways. Mr. Knox regretted that America had gotten this great start in electricity, which he recognized as the inevitable motive power of the next century, because, as he explains it, by this start is meant that similar industries developed abroad will be apt to be developed by American ingenuity and in many instances by American capital. Mr. Knox further points to the fact, apparently with regret, that the equipment of the Waterloo & City and Central London lines is all coming from America. When electric street cars were introduced at Leeds, the center of the locomotive district, all the motors were imported from the United States. A case is cited where American workmen had to be brought over to complete an electric street car line in Dublin.

But England is by no means the only country in Europe that is obliged to purchase American electrical apparatus and employ American labor, even if our exports of electrical machinery are far greater to the United Kingdom than to any other country abroad. Even Germany, which prides itself on its up-to-date electrical developments, and whose ambition is to eclipse with its electrical exhibits those from the United States at the Paris Exposition of 1900, purchased from this country during the last fiscal year $240,577 worth of electrical machinery, consisting principally of street railway equipments. Furthermore, General Porter, on his return from Europe some time ago, stated that he was constantly meeting in the different countries he visited, engineers in charge of electrical undertakings who were either Americans by birth or who had been trained on this side of the Atlantic.

* * *

Long Distance Independent Telephone Service.

In the question of long distance telephony the New York Telephone Company would seem to have a decided advantage over the People's Telephone Company which is earnestly seeking to gain a foothold in this vicinity. Many firms in New York City would undoubtedly be only too glad to patronize the new company and have the Bell instrument removed were it not for the fact that the Bell system enables them to reach points where no independent companies exist. That this unsatisfactory state of affairs will ultimately be remedied cannot be doubted, as new independent companies are constantly starting up all over the country.

Only recently a new company known as the Massachusetts Telephone & Telegraph Company was organized, with several million dollars capital, to compete with the Bell company in Boston, while independent telephone organizations may be found in Detroit, St. Louis and Indianapolis. That independent telephone companies are gaining a foothold all over the country may be gathered from the following statement of Mr. J. E. Keelyn which recently appeared in a New York daily:

"There is now competition by means of exchanges independent of the Bell in all the towns of importance between New York and Washington, excepting New Brunswick and Philadelphia. Work is under way on independent exchanges in all the cities between New York and Boston, and including Boston. If a foothold could be got in New York City the Bell company would be forced, first to reduce rates, second to furnish 'phones free, and third to go out of business.

"Let me tell you the experience in New Jersey. There are independent exchanges in Jersey City, Newark, Paterson, Passaic, Elizabeth, Bound Brook and Trenton. Further south there are inde-

pendent exchanges in Chester, West Chester and Coatesville, Pa., and in Wilmington, Del. But I will speak of New Jersey first.

"In Elizabeth the Bell company when the independent exchange was started had 225 telephones. It has 300 now, and the independent company has 400. Before competition came the Bell company charged $100. The new company charged $35 for business and $25 for residences. The Bell fell to $21 for business and $18 for residences, but it is actually furnishing telephones free to persons who have ordered them out. The Bell is practically driven out of Elizabeth.

"In Newark the Bell company had 2,400 telephones, and charged $120 a year. A new company was started but made the mistake of putting in too cheap a plant. The plant has been rebuilt, and 2,000 telephones are in operation, while arrangements are being made for 2,000 more. The new company charges $48 for an unlimited service, and the Bell came down to $40. Soon the Bell will have nothing of real value in Newark but its long distance connection.

"The independent exchanges in Paterson and Passaic will soon be connected with Newark. There are 650 independent telephones in operation in Jersey City and 1,000 in Trenton.

"Chester, Pa., furnishes a good example of what can be done. Chester is a suburb of Philadelphia. The Bell company has 225 telephones, and charged $80 per year. After one year the new company has 600 telephones in operation, charging $30 for business and $20 for residences, has paid dividends regularly, and its stock is twenty-five per cent. above par. The Bell company is giving service away in Chester."

Mr. Keelyn further states that at the present time there are as many as 3,000 independent telephone exchanges in the United States. Such being the case it can readily be seen that as soon as independent companies succeed in gaining a foothold in the principal cities, such as New York, Boston and Philadelphia, arrangements could be made for long distance independent service equally as good as that now furnished by the Bell monopoly and at probably one-half the price now asked.

* * *

Seeking to Expand Our Export Trade.

We are in receipt of a memorial gotten up by the Merchants' Association of New York, addressed to the President of the United States, the Vice-President, members of the Cabinet, and to the members of both Houses, urging the passage of a bill, No. 2,524, entitled "A bill to increase the efficiency of the Foreign Service of the United States, and to provide for the Reorganization of the Consular Service."

There is probably no more important question before the electrical fraternity of the United States than that of the expansion of our exports in electrical goods and the ways and means of accomplishing it. The proper solution of this question is not only worthy of, but requires, the most thorough and exacting study. The search for foreign markets for our goods may be said to have developed in late years to an exact specialized science, in which not only individual exporters and associations, but expert Government commissions, elaborately organized, equipped and maintained, lend their efforts to the expansion of our export trade.

The fact seems to have been conclusively proved that markets for our goods can only be obtained and retained through an intelligent study of the wants of the various markets of the world, an absolute willingness to cater to those wants, and the expenditure of necessary capital and energy sufficient to make that willingness known. The Consuls can give information about markets, the nature of the goods required, and can encourage foreign trade in many ways, and it is with a view to making our Consular Service more efficient in this respect that the Merchants' Association of New York is striving by advocating the bill now pending in Congress, which in the memorial just distributed is referred to as follows:

"We have believed for some time that, properly to expand our export trade of manufactured products, it is necessary that the Consular Service of the country be placed upon a better footing than that upon which it stands now.

"The bill in question, while a radical one, we think provides the change by which the Consular Service of this country can be made to do for this country in the export of manufactured products what the Consular Service of Great Britain and Germany does for those two nations, and that it will do more to place properly before the consumers of the world at large, through the accredited channels of the Government, the superiority of American manufactured products than any other means that can be adopted."

This measure, as we understand it, contemplates the removal of the Consular Service of this country from politics, the appointments being made, after a suitable Civil Service examination, for life, subject of course to good behavior and efficiency. Positions left vacant through death or otherwise would be filled by promotion, or in other words, the system would be very similar to that now in vogue in Great Britain and Germany, which has done so much to stimulate the export trade of those countries. The changing of our Consuls by every incoming Administration cannot but work harm to the export interests of this country, as a Consul no sooner becomes familiar with the requirements of the locality to which he has been assigned than a new Consul is appointed who has to spend considerable time familiarizing himself with the new conditions. That the Consular Service of the United States is even now doing good work is not to be doubted. As every one knows, one of the most valuable offices which our Consuls perform is to gather information abroad as to the methods in vogue in conducting business and also in giving advice as to how we may extend our markets. They are watchful to discover any openings for the introduction of American manufactures, and it is unquestionably largely due to their efforts that American manufactures have attracted so much attention in foreign markets. Their reports to the Bureau of Foreign Commerce of the State Department are replete with suggestions that are of the greatest value to our manufacturers who are struggling with the export problem.

The bill which the Merchants' Association is so strongly advocating, providing it becomes a law cannot help but still further improve our Consular Service, and for that reason it should receive the support of all those interested in the export question. Although valuable suggestions are constantly being received from our foreign Consuls, one trouble is that they are not always heeded, and that manufacturers seeking a market for their goods give as a rule very little thought to the needs of the people they desire to do business with. So long as American manufacturers persist in sending what suits them, instead of what their customers desire, they will fail to build up anything like a profitable foreign trade, in spite of any improvement in Consular service.

A BRIDGE of 900 feet span at Budapest is being erected entirely by means of electrical machinery. The iron girders used as piles to keep the water back from the excavations for the shore pillars were driven in by an electric ram. The ram was a hammer rising 34 feet, with a velocity of 12 feet per second. The soil out of the holes was raised by an electric windlass. The water was removed by seven centrifugal pumps working day and night. The five-inch diameter pumps were driven by 10 horse-power motors, the eight-inch by 16 horse-power, and one nine-inch by a 20 horse-power motor.

Under the Searchlight.

Notes and Comments on Various Topics.

CUBA was Uncle Sam's New Year's gift, and we wish him joy of it. It adds something to the tug on his trowser straps, but his shoulders are broad and his gallowses strong, and no one need fear that the additional load will destroy the symmetry of his figure or diminish the sweetness of his grin. As shown in the picture papers nowadays the old man looks as if he had been rejuvenating himself by a course of electric baths.

* * *

RICHARD CROKER, JR., son of the Tammany Hall leader of New York City, has discovered a future for himself in the electrical industry, and will commence his business career on the pay-roll of the Westinghouse Company.

* * *

MAYOR CHASE, the only Socialist elected by an Eastern municipality to the headship of a city government, was inaugurated at Haverhill, Mass., on Monday. The Mayor advocates in his inaugural address the municipal ownership of electric lighting plants and street railways—of course.

* * *

EXPERIMENTS of an interesting nature have been made with a new explosive, liquid air, and with encouraging results, under the conditions of trial. This is reported as having been the case with tests made on the parade ground at Munich, and an exhaustive test on a large scale is reported as having taken place in a coal mine at Pensburg, not far from Munich, trials which, continued for months, proved very satisfactory. The chief advantage claimed for this explosive is its slight cost, being simply that of the power used in liquefying the air. Even the fact that after a short time the substance ceases to be capable of exploding is urged as a recommendation in one respect, for, if a detonator hangs fire, there is no danger of the charge going off accidentally some time after the explosion is due.

* * *

ELECTRICITY has in the past unquestionably been responsible either directly or indirectly for many deaths, but a death recently occurred due to the drinking of the "fluid" from an electric battery, which is probably the first case of the kind on record.

* * *

THE Prince of Monaco has been known since 1885 as an enthusiastic student of the sea and its various forms of life. One afternoon, while in the Bay of Biscay, he sank the trap in which he collected specimens. It went to the bottom in over 12,000 feet of water, and as night approached he fastened to the wire attached to it an electric buoy and then stood off a mile or so. As he and his fourteen sailors were watching with a good deal of satisfaction the swaying buoy with its brilliant illumination a steamer's lights came into view. It was soon evident that the steamer was curious to know the meaning of the illumination, for she altered her course and made for the light. Up she came to within a quarter of a mile of the buoy, slowed up for a minute, and then started ahead, perhaps a little disgusted at the incident that had lured her several miles out of her course. She had hardly got away when a second steamer came into view, and she too bore down upon the lighted buoy. The sailors on the Prince's vessel understood by this time that the illumination was probably believed to be evidence of a disaster. Just as the Prince's steamer was moving up to explain matters she was nearly run down by one of the large liners in the Oriental trade, which had also left her course to render what assistance she could.

The incident proved of value, for thereafter the Prince carefully refrained from exhibiting his electric buoy on any of the much traveled ocean routes.

* * *

WHAT is termed an over and under ground street railway system has recently been patented. With this system it is claimed that the difficulties experienced in running cars during the winter, when the tracks are covered with snow, will be overcome. The inventors employ a large conduit, in which the tracks are laid, while the body of the car runs above ground. The trucks will run on the underground track, and a support will extend from each track, through a slot, to the bottom of the car. The cost of excavating for a system of this description in a city like New York would in all probability prohibit its ever being adopted.

* * *

ONE thing the Cuban ruralist must learn, says the *Telegraph Age*, is not to cut down telegraph wires when he wishes to bale his hay. The custom is not strictly up to date.

Proposals Invited by the Government.

The Bureau of Yards and Docks of the U. S. Navy Department is inviting sealed proposals until January 14, 1899, for extending the electric light system at the New York Navy Yard. Specifications, blank forms of proposals, and a general plan will be forwarded to intending bidders upon application to the Bureau or to the Commandant of the yard. Bidders are expected to inform themselves of the character of the work by visiting the Navy Yard.

The War Department, through the U. S. Engineer at Norfolk, Va., is inviting sealed proposals until January 24, 1899, for furnishing and setting up four storage batteries at Fort Monroe, Va. Information will be furnished upon application to Major Thos. L. Casey, 166 Granby street, Norfolk, Va.

RONALD T. McDONALD'S DEATH AND BUSINESS INTERESTS.

(*From the New Orleans Picayune, December 25.*)

The news of the death of Mr. R. T. McDonald was a shocking surprise to his many friends and acquaintances in this city. He had been in New Orleans within the past fortnight, and left here in apparently perfect health on the 14th inst. It was known here that he was taken sick shortly after he reached Dallas, whither he went to meet his private secretary and superintendent, W. H. McGrath, of the ice and electric light plant in that city, in which corporation he was largely interested.

He was robust, and might have been considered a fine specimen of manhood. His friends here apprehend that it was over-confidence in his vigorous constitution which caused him to disregard the danger of that insidious malady, and thus was finally developed the attack which proved fatal while so far away from his home and family. He went to Dallas alone and had expressed his intention of returning here without delay. Attention might be called to the coincidence of the sale of the municipal ice plant of this city, in which he was a large stockholder, having been consummated the very morning of his death, the sad intelligence being received here within an hour or so after the sale had been made.

A SUCCESSFUL PROMOTER.

He was regarded as one of the most successful promoters of public interests throughout the country. He first became identified with interests in the Crescent City in 1885, by becoming interested in the Louisiana Electric Light & Power Company, through the Ft. Wayne, Ind., Electric Light & Power Company. Associated then with Mr. Maurice J. Hart, he extended his interests into the traction, sewerage, ice and other corporations. Through business misunderstandings he and Mr. Hart became estranged, which resulted in some rather sensational litigation, the outcome of which was the recent decision of Judge King, of the civil district court of this parish, with judgment in favor of the Harts in the sum of $11,000, which judgment is now on appeal before the Supreme Court.

Mr. McDonald was born in Allegheny, Pa., June 24, 1849, and went to Fort Wayne in 1860. During the war he served in Company C, 152d Indiana Infantry. Returning to Fort Wayne, Mr. McDonald worked as a clerk in a dry goods store, afterwards becoming a member of the firm of Evans, McDonald & Evans, wholesale dry-goods dealers. The firm failed in 1881, and two years later Mr. McDonald established the Fort Wayne Electric Company, which has since become famous. He was a director in two Fort Wayne banks, was at one time a director of the Fort Wayne Consolidated Street Railway, was exclusive owner of the artificial ice plant in that city, owned the new Avenue Hotel, Riverview Stock Farm and innumerable smaller properties. He was the owner of the Broad Ripple Street Railway in Indianapolis, principal owner of the Hoffman House, New York, was interested in the New Orleans artificial ice plants, and had electric light interests in Chicago, Detroit, New York, St. Louis, Brooklyn, Syracuse, N. Y., and other cities.

THE BELL BOY'S FRIEND.

A lifelong friend of the bell boy is gone. Mr. R. T. McDonald was a favorite among all the "fronts" of the hotel where he stopped. The news of his sudden and unexpected death was received with more profound and sincere regret by no one than by the bell boys of the St. Charles Hotel. One by one they passed the word along the line, and when the noon watch went off duty they told the other watch that R. T. McDonald was dead. The boys spoke of little else during the afternoon. His arrival was always the signal for good cheer among the lads who wait upon the bench and answer calls.

WELL KNOWN IN BALTIMORE.

(*From the Baltimore Sun, Dec. 27.*)

Mr. Ronald T. McDonald, president of the Fort Wayne Electric Corporation, who died on Friday at Dallas, Tex., was well known in Baltimore. He came to Baltimore about 1890 and purchased from the receivers the International District Telegraph & Construction Company, which had operated the Heisler system of electric lighting. From this he built up the Maryland Electric Company, which under his direction in five years had an earning capacity of $300,000 a year. Mr. J. Frank Morrison was the representative of Mr. McDonald in Baltimore. About two years ago Boston capitalists bought out Mr. McDonald's interest in the Maryland Electric Company and changed the name to that of the Edison Electric Illuminating Company. Mr. McDonald a few years ago leased the Wenstrom Electric Works at Calverton, and began the manufacture of motors and dynamos. The franchise of the Wenstrom Company was recently sold. Mr. McDonald had two homes, one in New York and the other in Fort Wayne, Ind. He is survived by a widow and a fifteen-year-old daughter.

THE NEW POWER STATION AT SHEFFIELD, ENGLAND.

Of all the work of various kinds that is being carried on at Sheffield preparatory to the change in the system of tramway traction, says the *Surveyor*, the erection of the electric power station on Kelham Island, from which all the power for driving the cars will be obtained, is considered to be the most important. As a center for a power station Kelham Island is said to be admirable. It fulfils the essential conditions of being within a short distance of the lines, so that the current may be conveyed with as little waste as possible, and of providing space for any extensions of buildings that may be required in the future, as the tramway system is gradually enlarged, and lines cover all the principal streets of the city.

The buildings are so contrived that they can at any time be extended by additions to one end. The site of Crowley's Foundry premises which the corporation have bought is very large, and hardly half the land is at present being used for the provision of a station which is calculated to supply power to all the present lines and as many more as will be ready when it is completed. As a matter of fact, by no means the whole of the ground has been cleared and the large portion of the old buildings left standing are being used as temporary stables and stores. The station consists of two large oblong buildings, the largest of which, the engine and dynamo house, occupies about 5,000 square feet, and the smaller, which is for the boilers, about 3,500 square feet. Thirty or forty men have been at work since the beginning of July, and very good progress has been made. The buildings are of brick, plain and neat, substantial and in character with the kind of work for which they will be used. The most tasteful-looking elevation will be that on the south side, where the wall, 40 ft. high, will be pierced by two rows of windows, those in the lower story placed together in pairs, and those higher in groups of three. This will be the wall of the engine-house, the inside measurement of which is 100 ft. by 50 ft.

The heavy foundations have been carried down to a depth of 10 ft. below the ground line, and afford space for six engines. At first only three engines are to be put in. These will be of 300 horse-power, supplied by an American firm, and will be coupled to dynamos having a capacity of 225 kilowatts so arranged that they can be used independently or all worked together. A short time ago it was anticipated that one dynamo would probably prove sufficient to work the traffic, but the corporation seem now disposed to push on the extensions of the lines at a greater speed, and it is not unlikely that additional engines will be required before the house has been long in use. As already explained, however, it will not be necessary to extend the building for the first additions to the stock, as the beds of three more engines are already outlined. When extensions are needed the east end will have to be removed, and it will be possible to go on lengthening the building for a long time before all the land is covered. The same means will be adopted for enlarging the boiler-house, which adjoins the engine-house, standing nearer the river. This is at present 76 ft. long by 40 ft. 6 in. wide, and will hold three boilers, each of 300 horse-power, and fitted with patent induced draught supplied by fans working in the power-house. The boilers will be 10 ft. square at the base.

The brickwork of the engine-house is being filled into a skeleton of steel framework as large as any recently used in Sheffield. Ten upright steel stanchions are fixed, eight of which are 50 ft. high, and the others 10 ft. or 15 ft. lower. Across these are laid steel beams, which will support the roof trestles, and to which can also be fixed a traveling crane, by means of which any portion of the machinery can be removed without unnecessary delay. It was at first intended to have steel framework for the boiler-house as well, but there was a difficulty in obtaining the material, and this part of the design had to be abandoned. As it was, the work was considerably delayed by the slow arrival of the stanchions for the engine-house.

The boiler-house will be lined with salt-glazed bricks, so that the sanitary measure of washing the sides can be taken from time to time, and glazed bricks will line the engine-house. The height of the two buildings from the floor to the eave of the roof will be about 40 ft. Along the roof of each will be a long lantern, which will admit sufficient light. The side of the boiler-house will be lined with coal bunkers some 12 ft. wide, and at one end there will be a tower for the tanks. Lavatories are provided in the building. Such good progress has been made with the work that if there is a continuance of fine weather the building will probably be completed by the end of March.

ELECTRICAL CANAL TRACTION.*

The *Bulletin* of the Association of Electrical Engineers of Liege for May of the current year was entirely devoted to the question of canal traction, mechanical and electrical. While far too lengthy to produce in extenso, or even to abstract at any length, we hope in the following series to be able to give such a resumé of the salient points as will be of use and interest. The canals of England languish in the grip of the railroad interest, but the time must arrive when even a Parliament, packed with selfish railroad directors, must give attention to so vital a question. The author of the paper which appears in the *Bulletin* was Mr. Van der Wallen, who remarked at the outset that canal traction was to-day in a very backward state considering the great development of late of different modes of traction. Everywhere one sees animal haulage, the animal being victorious over the numerous tentative efforts to replace him by mechanical means.

All canals have been built with a view to haulage in some form, and it is to improve on this mechanically and economically that efforts should be made. On rivers and large canals the problem is different. Self-towing and towing are the only practicable means capable of being utilized. Self-towing on a chain is excellent on rapid streams of small depths having at least a slope of 0.30 m. per km. The draught of water augmenting and the slope falling below 25 cm. the tow boat sees its superiority well reduced. On the descent the advantage is always with a tug, for the tow boat is fast to its chain, and if the current is rapid the towed boat may overrun the tug and collide. Towing is understood to be towing upon a sunk chain—as distinct from tugging by means of a free boat. From an economical point of view the fuel expense of towing is only about one third that of tugging, but there is the inconvenience of being fast upon a chain, so that if the traffic is stopped the tow vessel is idle, but a tug has a much wider field and can go anywhere, and moreover, is of less first cost. Some large companies have both paddle and screw tugs. Paddles are suitable in shallow waters, but are costly in construction and work. The company of the Lower Seine and Oise have vessels fitted both for chain towage and tugging. Up stream they are towers, down stream they are free tug boats, and they afford a service at once quick, regular and economical. MM. Molinos and Bovet consider this the best system of traction for canalized rivers.

Compared with the ordinary system of towage, there is less use of the chain, a stoppage of the chief causes of breakage, better utilization of plant, and an increase of the possibilities of traffic, with reduction of expense and the power to run down stream as free tugs.

Compared with tugs, the advantages of the double system are equality at times of low water and an incontestable superiority at times of high water. For such a service to pay, the traffic should be large and the locks also large enough to take a train of barges. A train of four barges, for example, occupies four hours, and a single boat less than 30 minutes, so that a convoy loses 90 minutes at each lock if of one boat capacity. Experience has shown that the mean speed of such a convoy cannot be over 3.6 kms. per hour on a canal which is much used. Similarly, a horse-hauled boat attains nominally 2 km. speed. To regain an hour lost at a lock a convoy would need to travel 6.750 kms. Thus the towage of trains of four boats cannot be carried out except at a disadvantage as regards speed unless the pools between the locks are each 6.750 kms. in length.

It is thus evident that the question of economy depends very much on the distance between, and the size of, the locks. To have a towing vessel, whether on a chain or with screw propulsion and the attendant expense in the shape of fuel, attendance and repairs, there must first be sufficient traffic to supply several barges at one time to be towed. The towing vessel must not tow a single barge, but a train. Now, if the locks are only large enough to pass one vessel at once—which is the case with almost all our English canals—there will be a considerable loss of time at each lock, and if locks succeed one another quickly, the journey speed will be very slow indeed. Clearly there is a good deal of thinking to be done upon each problem. On very busy canals, with pools of suitable length, it would be practicable to maintain the towing vessel always in its own particular pool. It would never pass the locks, but occupy itself in towing barges each way from lock to lock. Where such a system is practicable it would save time at the locks, and would also save a considerable difficulty at the locks in the shape of the management of the tow chain.

Another solution of the question is that of self-propelled barges. Erroneous apparently in principle, because of the idle time of the motive power at times of loading, yet it is capable of successful application for carrying goods necessitating high speed.

The use of gas and oil engines offers the chance of reducing some of the foregoing objections. One instance alone is cited—that of the French company Seine Maritime, which conducts a rapid service between the English Channel, Rouen and Paris by means of flats driven by gas motors. The gas is carried in steel tubes at a pressure of about 100 kgs. per cm^2; these tubes measure 250 mm. diameter, and are 5 m. long and 8 mm. thick to contain 22 m^3 of gas. They weigh 325 kgs. These tubes, to the number of 80, are connected in a battery by flexible joints. The motor is vertical, with two cylinders of 40 HP. total, of the "Simplex" type driving a screw on the Mo-Glasson principle, variable and reversible, which permits any speed from nil to maximum without change of speed of the engine. Two men manage the boat, a driver and a pilot. Such a boat will measure 300 tons, and will be 30 m. long, 5.50 m. beam, and 2.25 m. deep. Trials between Havre and Tancarville show that one minute is enough to set the motor going, and at 180 to 250 revolutions the flat, carrying 145 tons, travels 5½ to 6 knots.

This system appears to be the counterpart of gas tramway traction. It is necessary to have either gas compressing stations or that each vessel should be able to compress its own gas. This would be somewhat impracticable and costly, and gas haulage would seem only to be applicable under special conditions as to the supply of gas at the convenience of a suitable station for its compression, or the presence of a compressed gas main with connections for the boats at several points en route. Strong gas alone can be carried in reasonably small bulk, so that producer gas would be shut out, otherwise gas haulage seems very suitable for canal barge towing. It has one great advantage not possessed by the tramway gas traction, that, the resistance being practically constant, the gas motor may be exactly suited to its one duty—that of haulage at the level. On tramway work the gas engine must be very much larger than its mean power, for it must provide both for rapid acceleration and for the maximum grade. Electricity can do both, because in electrical work the energy comes from outside. In a gas engine the energy is generated by the engine, which must be large enough for its highest duty, and, unlike an electric motor, cannot be overloaded. An electric motor will utilize a heavy current for a few minutes and is at a great advantage in this compared with gas. On canal work, however, these particular advantages lose their value, and in canal haulage we should expect gas to give good results on such systems as were suited for its adoption.

The following are stated as essentials of mechanical canal traction: A power of 3 HP. to 4 HP. effective, capable of being augmented, even at a reduced speed, at the passage of a lock.

The systems at present capable of filling these essentials may be placed under three heads:

(*a*) An endless cable kept in constant motion to which barges may be attached.

(*b*) Machines in place of horses, running the length of the canal.

(*c*) Temporary motors placed on board the boats and easily moved so as to serve any boat, and so be utilized without interruption.

Under the first head comes cable haulage, first proposed in 1862, and now only of historical interest.

The moving cable does not seem to have been a success. One difficulty was the obliquity of the pull on the cables and the difficulty of passing the haulage rope past the carrier pulleys. It was difficult to attach tow ropes to the moving cable, and there was the sudden pull on the rope as soon as attached, and no time was allowed to the boatmen to get aboard again. To enable the tow rope to quit the pulley groove, the flanges of the latter were notched, and when the notch came round it admitted the tow rope and so led it off and out of the groove, the straight running main rope not catching in the notch. We need not further follow the description of this rope system, which is fully described and illustrated in respect of grips and pulleys. The system is not one likely to come into use in face of the possibilities of electric traction. Unlike tramway cable traction, the moving cable in barge haulage cannot receive back any power from boats as does a tramway cable from cars running down hill. Then it is obvious that there must be an enormous loss of power by friction at the numerous pulleys, especially at curves where the rope has a heavy lateral pressure on its carriers.

Under the second head, that of traveling machines, it is remarked that at the outset no success accompanied the system. A trial was made with a locomotive running on the bank of the canal of Neuff-Fosse, between Fontinettes and Douai, on a length of 77 kms. with one lock only. The line was ballasted on a width of 2 meters and a depth of 0.3 m. The rails weighed 15 kgs. per meter, and were laid on cross ties of wood spaced 1 meter apart. The locomotives had four coupled wheels and weighed 14 tons in working order, which seems an excessive weight, but each train consisted of two or three boats, and the speed was 1,500 kms. per hour. The chief cause of the abandonment was the cost of the railway, and the heavy engines required. In 1892, however, electrical traction was tried on the patent of M. Galliot, upon the canal of Bourgogne. The Society Decèfle & Cie., who worked the patent, constructed a kind of electrical tricycle. The overhead trolley system was employed. The cable was fixed behind, between the motor wheels. The motor is bipolar of 6 kw.

The shaft gives motion by a bronze worm to a wheel on the axle of the driving wheels, which are of iron wrapped in aloes fiber for elasticity and grip. The vehicle carries a light cab or shelter in which the driver controls the machine with the necessary levers and foot brake. The whole machine only weighs 2 tons.

A third system is that of Lamb, and consists of electrical motors running on cables and hauling boats as in the previous system. A strong cable is carried on posts on the bank. A carriage runs on this cable carrying a motor which drives a wheel by means of a worm. Round this wheel is once wound a second or traction cable. The haulage rope is attached to the carriage. The two cables are so isolated as to serve for conductors. The worm runs in an oil bath with very little friction. The motor can be driven from deck by means of suitable wires carried on the haulage cable, or there may be a driver seated on a suspended seat from the motor itself.

M. Busser proposed in 1893, at the Chicago Congress, to place a motor in a float attached to the rudder of a barge, and to drive a small screw pro-

* From the *Electrical Review*, London, Dec. 9, 1898.

peller therewith by means of a chain, and a similar proposal was made by M. Galliot at the Congress of the Hague, a screw propeller being driven by a motor through a vertical shaft in the rudder post.

The Bovet system consists of chains laid in the canal itself and simply carried over wheels on the barge, the barge mechanism being electrically actuated from overhead conductors. An ordinary chain is sufficient, and has the advantage that it will slip at times of abnormal stress and so obviate accident. The following formulæ are given for calculating an establishment of this type. Given T the annual tonnage in millions, K the journey of a boat in km., and C the load of a boat. Then 300 C K represents the tonnage per km. The number of boats in circulation per km. will be $n = \frac{10^6 \text{ T}}{300 \text{ C K}}$. Their headway in kms. will be $e = \frac{600 \text{ C K}}{10^6 \text{ T}}$. Thus on a length of 60 kms. the annual traffic being $3\frac{1}{2}$ million tons, and the boats of 200 tons burden, traversing 30 kms. each, if the journey speed be 12 hours the velocity will be 2,500 m. per hour.

Each boat is estimated to require 3.2 kw. of energy or a total of 275 kw., or 535 HP., allowing 91 per cent. output of generator. These values are arrived at from the formula $r = (a + b\,t)\,\text{v}^{2.25}$ where v is the speed in meters per second, and t the draught in meters; r being the resistance in kgs.; a and b being—a 21.3, 21.5, and 14.2, and b 123.6, 78.1, and 52.4 for three classes of boat known in France as the *Peniche*, the *Flute* and the *Toue*. The formula is applicable to speeds of .25 to 2.5 m. per second, and draughts of 0.65 to 1.83 m.

It is advised that for steam power there should be a power station on each section. Gas engines, too, may well be divided up into several stations, and they have an advantage over steam for powers under 25 HP. Oil engines are, unhappily, too costly to run, or they seem best suited to power distribution for canal traction purposes.

Phase currents are not new in industry. Why, it is asked, can they not be used in canal traction? The necessity for three lines need not be a serious disadvantage as is sometimes urged. The polyphase motor is so simple and strong as to demand serious consideration where it will be worked by men little acquainted with electricity. The polyphase system is more elastic and permits of a variation in the haulage as required, whilst on normal duty the speed is steady. Current is taken from the line by means of a two-wheeled carriage with a pendulum counterweight, the grooves of the pulleys being shaped to clear the insulators. The carriage is drawn by the boat by means of the cable which carries the current on board. The return current is not practicable by way of the tow chain. A second wire is therefore provided as return.

The carriage seems better than the fishing rod system, for a barge is not confined by a rigid rail and the arm must be long and very adjustable.

The use of accumulators does not seem to be very practicable for canal haulage. They are referred to as having been applied in England to pleasure vessels on the Thames, E.P.S. batteries of 44 to 180 elements being used according to the size of the boat, and double-bladed screws employed directly driven by four-pole motors excited in series.

A trial was made in France by the Société Boulet et Cie. Fifty-two Gadot cells were employed to work a Gramme motor equal to 100 volts × 41 amperes, with a three-bladed screw at 300 revolutions per minute. Speed trials showed 1 km. in 4 minutes 18 seconds, or a speed of 14 kms. per hour. The battery gave 30 amperes in full discharge. At 80 per cent. efficiency the work performed was 3.25 HP.

The Gymnote, a submarine torpedo boat of the French Admiralty, was tried in 1888 at Toulon. It had a four-bladed screw of 1.50 m. diameter. The motor was of a 16-pole type. The poles were placed on a moving ring of 1 m. diameter, and furnished with a four-brush collector, two for forward and two for backward running. The speed was 250 per minute, and the screw was driven direct. The weight of the motor was 2,000 kgs. It gave 60 HP. with a 200-volt current and 220 amperes. The battery was 564 cells of the liquid alkali type Commelin-Desmazures-Baillache. Each cell weighed 17.5 kgs., or a total of 9,840 kgs. for the whole. With a capacity of 345 HP.-hours, sufficient for about 6 hours' run, this means 28.6 kgs. per horse power of charge. The speed for 6 hours would be 10 knots. Neither of these examples can be rated as commercial, however. For barge work the problem is quite different, and one must consider the question of the cost of loading and unloading the battery for charging, the shocks consequent on this and the damage to the cells, which rapidly deteriorate. It is, of course, easy to charge the batteries in place, given time to do so. This should be done without unduly delaying their work and might be done by night.

Relatively to tramway work canal haulage is much easier for accumulators. The following figures may be studied: A boat of 350 tons will run $4\frac{1}{2}$ to 5 hours at 3 kms. per hour with a battery of a capacity of 110 ampere-hours weighing about 1,000 kgs., and measuring 1.42 m² × 325 mm. high. For a tramcar the battery will have capacity of 180 ampere-hours and will weigh 1,750 kgs., and occupy an area of 2.16 m² of the same height—325 mm.—as the former. It is assumed that the weight of a battery in kgs. is a little over $\frac{1}{500}$th of its capacity in watt-hours. The displacement of a barge is, say, 339 tons, or 0.97 of the nominal 350 m³. At 3 kms. per hour its resistance may be taken as 0.37 kg. per m³ of displacement. The total traction is thus 125 kgs. The work per second is 104 kgm. or 1,020 watts, or say, 1,500 watts furnished to the motor. For a 6 hours' run the weight will be about 750 kgs. on the above rule. The rule is thus derived: Let I be the capacity of the battery, and I_1 its capacity per kgm. of plate. Then $\frac{\text{I}}{\text{I}_1}$ is the weight of plate per element. Add 0.65, then the weight in working order is $1.65\,\frac{\text{I}}{\text{I}_1}$. At the tension E there will be $\frac{\text{E}}{1.97}$ elements, whence the weight in kgs. is $\frac{1.65\,\text{E I}}{1.97\,\text{I}_1}$ for the batteries of the Société Electric. The current available is 15 ampere-hours per kg. of plate, but only two-thirds this is guaranteed. For 10 ampere-hours, therefore, is found by substitution in the above formula 0.0838 E I.

As before stated, there is an electrical system on the canal Bourgogne on a length of 6 kms., of which 3,300 m. are in tunnel. This length is the summit level. It receives large quantities of water daily, at least 30,000 m³ in all seasons, of which 18,000 go to the lock at Pouilly and 12,000 to that at Escommes. At Pouilly there is a fall of 7 m. or 19 HP., and at Escommes one of 8 m. or 15 HP., a total of 34 HP. Being similar, one only, that of Pouilly, need be described. The turbine is of Girard type, 1.16 m. in diameter and 100 revolutions per minute, geared to a shaft at 200 revolutions. It is regulated by a sluice electrically operated. The dynamos are of 11.6 and 9 EHP. of Gramme type. The ordinary work requires 370 volts (280 only at Escommes) or 23 amperes. The generators are in series and shunt wound because the employment of an accumulator was intended. The winding is condemned as causing great sparking, and if wound in series this fault would be absent, but it would be inconvenient for battery charging. Moreover, each machine tends to reverse the other's polarity.

At the time of starting a boat the turbines are only overcoming friction. By too rapid absorption of current at the motors, the turbines are overloaded and run slowly; as the fall at Pouilly is less than at Escommes, the Pouilly dynamo is liable to be reversed in polarity. Frequent at one time, they have been checked by a powerful rheostat of 180 ohms resistance so as to prevent too rapid admission of current to the motors. Slow movement of the rheostat enables the turbines to follow up their increased loading.

The advantage of the arrangement is that three conductors alone are required, one directly between the dynamos and two outer ones across which the motors work. The length of the electrical circuit is constant, and the current thus does not vary as the boat travels. Coupling in parallel would require four lines. Lower voltage is also possible with less line loss. The conductors are of telegraph bronze 8 mm. in diameter and of 45 kgs. per mm² tenacity, and 98 per cent. conductivity. The circuit resistance is 3.9 ohms. When under 600 volts the current is of 20 amperes. The fall of potential is 78 volts and the efficiency output 87 per cent. The conductors are carried by transverse iron carriers from posts. In the tunnel portion they are held by iron staples driven into the crown of the arching. They are hung by stirrups from the insulators. The middle wire simply passes over the throat of the insulators and is secured by brass wire. There is a tendency to sparking at the stirrups which have to be made thin to remedy this fault.

The advantages of the system are rapid erection, non-rigidity, absence of solder, different lengths being coupled by screwed bronze sleeves right and left threaded, the surface of contact secured being considerable, and they serve also to lengthen or tighten the line. Two trolleys are employed on a rod $7\frac{1}{2}$ m. long, of which 4 m. is of iron tube, the rest being bamboo. The pulleys are protected by india-rubber guards against short-circuiting if derailed. The motor is of Gramme type, series wound. At 550 volts and 30 amperes it gives 19 HP. at 900 revolutions. It is belted to the fly-wheel of the gearing, which is so arranged as to give a speed of 20 or 40 to the chain wheel, corresponding to a rate of travel of 0.65 or 1.30 meters per second. The chain runs in the middle line of the barge. The barge is lighted as it passes the tunnel by two series of lamps, arranged so that as the rear lamp is extinguished a fresh one lights up, the length of the barge being thus constantly illuminated. The accumulators contain 250 elements. Their normal capacity is 15 amperes discharge rate and 10 amperes charging. The battery is shunt connected to the line and serves as a steadier, not being required as a store, for there is no lack of water. It is placed at the generating house, though formerly it was on the towing vessel, and caused damage by acid vapors. For a period of six months the cost of transport has been 0.071 franc per ton, or about $\frac{3}{4}$d., showing an economy of 30 per cent. over steam towage at 0.103 franc. The air of the tunnel is, of course, no longer rendered suffocating by the smoke of coal, and the speed obtained is good.

Use of a Voltmeter in Electro Diagnosis.

Richard Cornaz, of Berne, contributes a long article to the Archives d'Electricité Medicale (October 15, 1898), relating an interesting series of experiments made with a view to determine whether the EMF. or intensity of the current necessary to produce muscular contraction was the more reliable as a factor in diagnosis. A combination galvanometer and voltmeter made by Gaiffe, of Paris, was used to determine the number of volts and milliamperes. Experience showed that the records for a minimum contraction usually varied during the same seance and at different seances. It was found also that the voltage varied a good deal less than the intensity, and one interesting case showed what mistakes in diagnosis might arise from trusting to the milliammeter. A patient suffering from traumatic neuritis of the right radial nerve was experimented on. With faradism the same strength of current gave

the minimum contraction whether applied to the right or left ulnar nerve. With galvanism the voltage for a minimum contraction varied in seven tests made at one seance from 5.8 to 7.2 on the right side, and from 6.4 to 7.8 on the left. The milliamperes varied on the right from 0.8 to 1.3, on the left 0.4 to 0.9. Taking the mean and comparing side with side the voltage varied from 6.4 on the right to 7.1 on the left, while the intensity varied from 0.67 on the left to 1.0 on the right.

In another series of experiments the voltage varied from 5.32 on the right to 5.2 on the left and the intensity from 1.35 (right) to 0.524 (left). Here then were two normal ulnar nerves presenting the same faradic excitability, which reacted to about the same voltage, while the intensity varied almost as 1 : 2. But if one divides the voltage by the intensity to get the resistances, one gets the reason for the great variation in the intensity. The maximum resistance on the right side was 4,000, on the left it reached 10,000 ohms. Basing one's opinion on the readings of the milliammeter, one would say that the excitability of the right ulnar nerve is diminished one-half since more than twice the number of milliamperes is required. As a matter of fact the right ulnar is healthy and shows no trace of either motor or sensory paralysis. Over 1,000 tests were made, and in all but one the variations in the voltmeter were much less than in the galvanometer.—*Journal of Electro-Therapeutics.*

NOTES ON THE DISTRIBUTION OF ALTERNATING CURRENTS.*

BY SIDNEY E. T. EWING.

Great diversity of opinion exists among engineers as to the best and most economical methods for the distribution of alternating currents. In a few years' time no doubt as great uniformity will obtain as is now the case in continuous current work, but at the present the variations of opinion and practice are very striking, hardly two stations in the country being alike, save perhaps when they are the work of the same firm throughout, and have not been subjected to the ideas of an independent consultant. The following notes are intended to indicate the apparatus and methods in most general use, with such comment as seems likely to be of service to readers:

General Conditions of Economy.—From the point of view of economy, the general aspect resolves itself into the just proportioning of the interest charges on the capital cost and the cost of generating the units lost in distribution. Naturally many factors enter the question which render the best solution in individual cases very difficult to decide. Two examples exhibiting very different conditions may be cited. The one is a company whose compulsory area is very large and scattered, and whose available capital at the outset was unduly small. In this case the only way open was to put down high-tension distributors in conjunction with house transformers. This was done and enabled a start to be made on a fairly paying load, drawn chiefly from a residential district, and for some years a good dividend has been paid. At the present time, however, the ratio of the number of transformers in circuit to that of consumers is as one to three, and as most of the transformers are of the old make and poor design the magnetizing load (true watts) is nearly 9 per cent. of the maximum load on the station. The other example, offering a very complete contrast, is the undertaking of the corporation of a rather densely populated town about the same size as the above. In this case the consulting engineer, having plenty of capital at his command, arranged for some thirteen well-equipped sub-stations in the central area, and a network of low-tension mains in all the principal and secondary streets of sufficient section to meet any probable demand for several years to come. A number of large transformers were also installed, whose capacity far exceeded the demand after the first 18 months of working. The load taken up during this period being chiefly supplied to early-closing shops and offices—comparatively unremunerative customers—the undertaking has been heavily handicapped by the large interest charges. Thus in the former of these two instances an arrangement of plant which cannot be recommended in the abstract has enabled a profit to be made under circumstances which would have debarred a more efficient, and therefore more expensive, system from doing so; while in the second the adoption of a very efficient and permanent plant has resulted in an immediate loss, where a more modest beginning, with a more elastic system, would undoubtedly have enabled a profit to be made from the outset. Under any circumstances, however, it is desirable to have a good deal of flexibility in the distribution arrangements—that is to say, ready means of enlargement to meet the increasing demand that experience has shown may be always expected, without unduly burdening the undertaking in its early days.

High Tension Feeders.—High-tension cables are perhaps the part of the distribution system which the engineer most fears, though nowadays to nothing like the extent of a few years back. The failure of a feeder means in many cases the total extinction of a large number of lights until a repair can be effected, and unlike the low-tension mains, which can easily be arranged to help each other, the failure of a high-tension main is difficult to economically safeguard. A good deal has been written of how high-tension feeders should be duplicated and interconnected, arranged on the ring system, and so forth, but in these suggestions a cardinal point is often lost sight of. A high tension system is adopted in most cases—though not in all—less on account of the intrinsic beauty of high tension than because it enables the supply station to be moved to a considerable distance from the area of supply to the site most favored as regards the supply of coal and water and freedom from liability to injunction. Hence, high-tension mains are often so long that their capital cost approximates power for power to that of the shorter low-tension feeder, and complete duplication is too costly to bear consideration. In this, as in so many other questions in which absolute security has to be balanced against cost, a compromise is the best solution. Two sub-stations lying fairly close together, each fed by a separate feeder, may be interconnected by a main of the same section as the larger of the two feeders. A breakdown will then mean more or less irregularity of voltage over the area supplied by the two sub-stations, but the period of total extinction need only last until the requisite connections between the sub-stations has been made. The use of a "discriminating cut-out" would even prevent the extinction, but at present there is but little experience available as regards this accessory, which promises, however, to be a most valuable invention. If the low-tension mains fed from each sub-station are permanently interconnected, or if arrangements allow of so connecting on emergency, the voltage variation may be still further lessened. Nowadays makers are willing to guarantee their cables over a period of years, and undertake to repair all faults at their own expense during this period—a proviso of singularly small use to the user, for a cable breakdown has in nearly all cases to be repaired by the station staff within a few hours of its occurrence. Cables are always tested at the makers' works after many hours' immersion in water at something like five times the working pressure. If they are then carefully laid and jointed by men experienced in the particular class of cable, and subjected to a further pressure test to try the joints and end connections, they may be relied on not to fail for electrical reasons with considerable certainty. The all-important thing in the case of heavy cables is that they should not be unduly strained or otherwise injured during the drawing-in, and if the insulation is hygroscopic, that great care be taken that the joints and end connections are kept free from moisture during the making and sealing up. Large cables are very heavy, but are easily damaged by straining, so that the use of a winch for drawing them in is to be deprecated. Half a dozen men pulling on a rope can only exert a limited force, and experience will enable the cable-layer to judge whether a given length and weight of cable is offering more than normal resistance, which may be due to inequalities in the conduit, and whether it is safe to employ more weight on the draw-rope. Breakdowns on good present-day cables are generally due to mechanical injury, such as the bursting of water-mains, the crushing of conduits by road engines, workmen's picks, and so on—accidents against which it is not possible to thoroughly guard. The broadest distinction in cables is that between the ordinary double and the concentric class. Between these two lies the twin cable, consisting of two separate side-by-side conductors, made up in one sheathing, and having a slow twist round each other. The latter may be said to be electrically nearly equivalent to the ordinary double cable and mechanically equivalent to the concentric. There are some striking differences in electrical behavior between these two main classes of cable. The double conductor has more self-induction for a given length and less capacity than the concentric. With small currents the inductive drop is not important, but with large currents, and when drawn into iron pipes, it becomes a factor to be reckoned with. With currents amounting to several hundred amperes its use becomes impossible for distribution work. On the other hand, on long lines the capacity current of a concentric cable comes into prominence, especially as it varies directly as the impressed voltage.

Most readers will be aware from published statements that the capacity current of the Deptford trunk mains, having a length when looped of nearly 12 miles, is between 12 and 14 amperes at the working pressure of 10,000 volts. This current, though wattless, has to be allowed for by increased section of copper in mains and generating machinery. The behavior of twin cables comes between these two classes. Their inductance is lower than that of a double conductor, and their capacity higher. They are largely used in systems where a quantity of double cable has been already installed, for the reason that it is inadvisable to use a combination of double and concentric mains. The capacity between the outer conductor of a concentric main and the earth has the effect of lowering the potential of the outer to the neighborhood of the earth potential. Connected to a system of double-conductor mains, the potential of one main is thereby brought nearly to earth potential, whereby the difference of potential between the other main and earth is nearly doubled. This has generally been found to produce disaster. In cases where nothing but concentric cable is in use it is becoming usual to connect all the outers to earth at the station switchboard, arrangements being made that they can be disconnected singly for testing in compliance with the Board of Trade regulations. For ease of handling, and ease and cheapness of jointing, the ordinary double rubber-insulated cable decidedly takes first place. Concentric joints are rarely satisfactory unless they are made in a special joint box. Hence, a multiplicity of joint boxes of different sizes and shapes have generally to be kept which, being usually the makers' patents, are costly. The earliest were insulated with vulcanized india-rubber, and the trouble experienced some years ago has, it is to be feared, greatly prejudiced engineers against india-rubber as a dielectric for this class of work. Yet at the present time rubber-covered cables can be obtained of great reliability, and their use offers many advantages for small feeders. Being very light and flexible, they can be drawn in for considerably

*From the *Electrical Engineer*, London.

greater distances than lead-covered cables. Jointing is simple and rapid, and no special boxes or end connections are required. However, the price of rubber is rising so rapidly that at the present time a lead-covered paper or jute-insulated concentric cable is considerably cheaper than two rubber-insulated cables of the equivalent section, and it cannot be denied that they are fast falling out of use. The other dielectrics most in use are paper from which all traces of moisture has been removed, impregnated with a heavy hydro-carbon oil, and fibrous material, such as jute, impregnated with special insulating compounds of a bituminous nature. Both these latter classes are protected from moisture by a solid-drawn sheath of lead, which is further protected by a serving of tape and preservative compound. Paper insulation is extremely weak mechanically and very hygroscopic, but so excellent is the manufacture of these cables that immense quantities have been laid and are working successfully. Of late a decided preference has been shown for armored cables, which can be laid direct in the ground without further covering than a tarred board to notify the whereabouts of the cable when the ground is opened for jointing or repairs, and, it is fondly hoped, to warn off the ubiquitous navvy's pick. An armored cable costs rather less than one of similar make and cross-section, lead-covered, and an iron or earthenware conduit, but it is difficult to see that this fact justifies their use in all cases. The possibility of drawing out faulty lengths, or lengths of insufficient section, rapidly and without disturbing the streets is very valuable, particularly when the undertaking is in the hands of a private company and the town authorities are apt to look askance at frequent requests for permission to open roads. But in spite of this great drawback its use is undoubtedly extending rapidly.

In the great majority of cases at present no provision is made for counteracting the drop in pressure in the high-tension feeders at full load, beyond raising the station bus-bar pressures slightly during the full load period. At best this method can hardly be considered fully to meet requirements, and in future design there can be little doubt that a transformer with variable change ratio, or some equivalent device, will have to be placed in each feeder circuit, in which case the station pressure would be kept constant at the value necessary for the shortest or lightest loaded feeder. An important point to which little attention is usually paid is the safeguarding of men working on mains which are usually kept alive. The procedure in many stations is something as follows: The electrician in charge of mains telephones or sends a message to the engineer at the station asking him to take off a particular main or circuit, and when he is satisfied that this has been done he tells the jointer to proceed to work on that main. If by mischance the main was not taken off the bus bars, or was afterwards put on prematurely, or the jointer cuts the wrong main, the responsibility may be difficult to fix upon the right person. Nothing can be better, however, than the method adopted in some stations whereby the jointer, having received his orders, goes himself to the station, and, with the permission of the engineer, opens the switch and places a wooden panel over the recess, which he padlocks, taking the key away with him. When the job is finished he goes back to the station and gives up the key. A main may sometimes be fed from both ends, and in this case some engineers provide a short-circuiting plug between the inner and outer at the sub station or transformer pit, and make it a rule that this plug shall always be inserted before any work is done. The outer main is of course permanently earthed at the station.

(To be continued.)

ELECTROLYSIS OF CAST-IRON WATER PIPES.*

BY HAROLD P. BROWN.

The injury of water pipes by electrolysis is at present so well understood that my only excuse for again calling your attention to the subject is found in the peculiar and unusual conditions disclosed at Dayton, O., in an examination made last July. This city has a population of about 90,000, fully 80 miles of electric roads and over 225 cars. Electrically considered, it is cut into four parts by the Stillwater and Mad rivers, which unite to form the Great Miami, and by Wolf Creek, meeting the Miami two miles or so below. Three of these parts are further subdivided by canals.

The business portion of the city is thus practically located upon an island, and the electric current used by the street cars must follow the rails across bridges or pass on the pipes under the river to get back to the power house. Practically 90 per cent. of the entire current from the business portion of the city crosses the river on one 12-in. and one 10-in. water pipe, one 8-in. gas pipe and one 10-in. natural gas pipe.

The two main power houses are about one-quarter mile apart on the west side of the Miami River. A third but smaller power house is on the east side of the river, but quite a distance south of the business portion of the city. Two other roads have their terminals in Dayton, but their power houses are elsewhere.

Following my ordinary methods, a switchboard was mounted on a wagon, with a complete set of Weston electrical instruments, reading from 0.0001 volt per degree up to 750 volts and from one-half ampere to 150 amperes. At each hydrant along the electric roads of the city a reading was taken from the trolley wire to each of the four rails, from the trolley wire to the pipe and from the pipe to each of the rails. These measurements were made in sets of three in such a manner that any poor contact or any defective condition of the testing apparatus was at once indicated and corrected. The instruments had recently been compared with standards, and were known to be correct.

Over twenty-five hundred electrical measurements were made, and the results of the readings were plotted out upon a map of the city. Fifteen excavations were made, and the measurements repeated on the pipes themselves. A careful examination was then made of the physical condition of the pipes by J. H. Shaffer, metallurgist, and chemical analyses were made of samples of soil and the metals of the pipes and incrustations upon them. These were made by E. E. Brownell, E. E., and Jas. O. Handy, chief chemist.

These electrical tests showed that the pipes in the business portion of the city, 1½ to 2 miles from the power houses, were positive to the rails, and therefore subject to electrical corrosion. The highest readings in this part of the city were 4½ volts near Fifth Street Bridge and near Washington Street Bridge. Near the power house on the west side of the river the pipes were 9 volts positive to the rails, and the danger district extended about three-quarters of a mile to the west. In the southern part of the city the highest positive reading was 2 volts in front of the Oakwood avenue power house.

In making the electrical tests the time of the reading was noted, since the pressure depends on the amount of load carried at the power house, and will vary correspondingly in all parts of the city. For instance, in front of the power house of the People's Railway, on Washington street, at 5 P. M., during the heavy load, the pipes were 9 volts positive to the rails, while at 2 P. M. they were but 6 volts positive.

*Abstract of paper read before the meeting of the American Society of Municipal Improvement at Washington, D. C., Oct. 21, 1898.

It was at once evident that the danger district was extremely large, since in the area in which the pipes are positive to the rails they are liable to injury. This was verified by the records of the water board, which showed a large number of service pipe renewals. Unless a remedy for the electrical condition of the pipes is very quickly applied in Dayton it is certain that a large amount of excavating, replacing of pipes and paving will need to be done.

Cast-iron pipe is usually not affected by electrolysis, since the coating of adherent molding sand and tar paint protect it. In the ordinary soil an iron pipe submitted to electrolytic corrosion is covered with a layer of iron oxide, which is a poor conductor of electricity, so that with a given pressure, the deeper is the layer of rust and the slower the rate of corrosion. But, to my surprise, the soil surrounding pipes in Dayton gives an entirely different reaction when a current passes through it. The tar seems to be no protection whatever, and the surface of the pipe in the danger district is changed into a soft, black material resembling graphite and easily cut with a knife.

This material is such an excellent conductor that instead of checking, it tends to increase the action by reducing the resistance of the path through which the current must flow in order to reach the rail. Moreover, the stones and pebbles near the pipes are actually electro-plated with the metal of the pipe, whether iron or lead. This condition I had never before seen, and, as far as I know, it has not been previously reported. Since my Dayton report was published I have received a letter from Dabney H. Maury, Jr., superintendent of the Peoria Water Company, Peoria, Ill., in which he states that he had encountered the same phenomena.

In order to electrically deposit a layer of metal two things are necessary, first, a liquid which will dissolve the metal, and second, an electrical current exceeding 0.01 of a volt in pressure flowing away from the metal through the liquid. The fact that the pebbles are electro-plated showed that both these conditions exist, but in order to prove conclusively that the soil itself did not injure the pipes a pipe surrounded by the same soil was uncovered in another portion of the city where there was absolutely no trace of an electrical current. This pipe was on Logan street, near the canal; the records showed that it was put down in 1874, while the pipe taken out at the west end of Fifth street bridge had been in use ten years and exposed to electrolysis for four years. If the damage was caused by the soil itself, this pipe would, of course, have been in a worse condition than the Fifth street pipe, but the Logan street pipe was apparently as good as new.

To make the comparison absolutely beyond criticism, a section of each pipe was taken out, chemically analyzed and mechanically tested. The chemical analyses of the iron pipes were nearly identical, and are as follows:

	Logan Street Pipe. Per Cent.	Fifth Street Pipe. Per Cent.
Phosphorus	.789	.800
Sulphur	.073	.037
Silicon	2.270	2 500
Iron	Not det.	Not det.
Carbon combined	.13	.21
Carbon graphitic	3 43	2.88

The samples of the incrustation of the Fifth street pipe analyzed as follows:

	Per Cent.
Phosphorus	1.821
Sulphur	None
Silicon	Not det.
Iron	33 43
Carbon combined and carbon graphitic	7.12

This analysis showed that the percentage of iron was greatly diminished, while the percentage of carbon was more than doubled; careful investigation showed that the carbon was merely the amount originally in the pipe, the carbon being left, while a large portion of the iron had been carried away. The

chemical analyses of the soil showed that the solvent was produced electrically from carbonate of sodium and chloride of sodium in the soil. Neither of these by itself in the small proportion shown by the analysis would injure a cast-iron pipe covered with tar, though, as is well known, a strong solution of chloride of sodium or common salt will rust wrought iron, but in the presence of even 0.01 per cent. reduces the electrical resistance of the iron, and the passage of the current decomposes those salts and forms muriatic or hydrochloric acid, which dissolves the metals. Having thus determined the cause of the trouble, it remained to fix its extent. Fifteen excavations were made in different parts of the city to determine how much electrical pressure is required to seriously injure the cast-iron.

A pressure of 3 volts and less is found to cause a graphite coating not exceeding 1-32 inch in depth; the iron seems to be uninjured. From 3 to 4½ volts the thickness of the layer is increased in a ratio depending upon the length of time during which the pipe has sustained this pressure. With a knife or file soft spots can be found in a pipe from 1-16 inch to ¼ inch deep. With higher electrical pressures the extent of the injury is even greater. In all cases the damage is directly proportional to the pressure and to the length of time during which the current has been flowing, while it is inversely proportional to the distance between the rails and the pipes. In my opinion, all main and service pipes in Dayton are seriously injured where submitted to 3 volts pressure or more for two or more years when within 4 feet of the rails. This would mean less than one mile of mains, but with lead or wrought iron service pipes the pressure limit would be as low as one volt. Charles E. Rowe, secretary of the waterworks, however, feels that 17,513 feet of mains should be replaced at a cost of $77,000.

To determine what percentage of mechanical injury has been sustained by the pipes it was intended to compare the hydrostatic pressure required to rupture the Logan street and the Fifth street pipes, but defects in the apparatus employed prevented a fair test. The Fifth street pipe at 150 lbs. pressure leaked through the corroded spots, while the other pipe was able to stand 300 lbs. pressure. Test bars were cut from the best portions of both pipes, and broken on a Riehle testing machine. The average transverse strength of the Logan street pipe was 1,800 lbs. per square inch, as against 1,085 lbs. to the other. The tensile strengths were respectively 16,000 and 11,425 lbs., and the deflections were 0.25 and 0.20 in. Four years of electrolysis had robbed the Fifth street pipe of about 30 per cent. of its transverse strength and about 45 per cent. of its tensile strength, and had caused it to leak at 150 lbs. pressure.

Since I wished to avoid any suspicion of unfairness, I asked the managers of each of the three leading electric roads to allow their experts to accompany me, and to check my instruments, methods and readings. This was cheerfully done, and I received from the gentlemen information concerning their plants and connections, as well as every possible courtesy, during my examination.

The rail joints on several lines of road had recently been removed, the rail ends brightened with the sand blast and the "cast weld" joint applied. This was done by the railways with an idea that it would reduce electrolysis, as well as make a fine mechanical joint. It was a success mechanically, but was an electrical failure, as was shown by tests of individual joints and by electrical measurements of several stretches of 1,000 to 1,200 ft. of the four rails and of the pipes below them. The measurements were compared with others made last February on same rails before the "weld" was applied, when very small bond wires were used on the rails. There was practically no variation in the results, as would have been the case had the "weld" possessed high electrical conductivity. I found that two of the rails were carrying no current whatever, while the other two carried but one-twentieth of the amount of the current on the pipes below them.

I feel confident that if the railroads would unite in the expenditure of $5,000 to $7,000 for the proper electrical apparatus and connections, all the water pipes in Dayton could be maintained negative to the rails. Then the pipes would harden, as is the case with the section of the pipe which I have brought to show you. Moreover, any further electrolysis that might occur would be in the opposite direction, and would therefore add a layer of metal to the pipes instead of injuring them. I will not here enter into a discussion of the electrical methods required in Dayton to obtain this result, but it is evident that no plan heretofore suggested for electrolysis prevention will effect a cure there, owing to the unusual conductivity of the soil and the peculiar division of the city.

I should like to offer a few comments and four or five practical suggestions. Do not imagine because your pipes are not leaking or bursting that they are safe from electrolysis. If the electrical conditions are against them they are getting weaker day by day. On the other hand, do not antagonize the railway companies the moment that the subject of electrolysis comes up in your city. They are not intentionally injuring your property, and if a friendly talk is had and a joint investigation is made, you are likely to get the speediest and most satisfactory action. The railway manager is as much interested in stopping the trouble as you are; every pound of metal taken from your pipes means to him a heavy loss of power, increased investment for engines, boilers, dynamos and conductors, and if it is finally established by legal decisions that his current has injured your property he will have to settle the bill.

The best course for all concerned, it seems to me, is to take mutual action while that bill is small, and not wait until a bursting main during a fire spreads the loss over the entire community. The usual procedure brings a deadlock. The waterworks people discover signs of electrolysis, and at once pounce upon the railway managers. They either refuse to believe that they are responsible for the trouble and thus bring upon themselves a shower of threats, or they say that, although they cannot admit the fault is theirs, they are, nevertheless, willing, rather than earn the ill-will of the public, to do anything in reason if the others will only tell them what to do. Then the others suspect some cunningly hidden legal trap, and decline to give any directions whatever; and so nothing is done.

The following will be found practical suggestions:

(1.) Obtain complete and accurate information concerning the electrical, chemical and mechanical conditions of your pipes, especially in the vicinity of the power houses. The trouble may be confined entirely to the lead in the service pipes and in the calking of joints on your mains, but even here serious damage may result if the matter is neglected for years.

(2.) Do not put down any more lead or wrought iron service pipes, as these are the first victims of electrolysis, and their replacing means ruin to pavements. Use instead wooden pipe banded with a close spiral of hoop iron and covered heavily with asphaltum. This will stand the heaviest pressure in use, and is not affected by electrolysis, since the hoop iron is low in conductivity and is not electrically connected at the joints. Its cost is said to be reasonable, and it has a successful record of many years' service.

(3.) Use the same kind of pipe for new mains in any district in which a railway power house is likely to be erected, and heavily paint the red calking of cast iron mains, using asphalt or petroleum wax.

(4.) In the danger district along the lines of electric roads and on intersecting streets put into your water and gas mains two or more consecutive lengths of those wooden pipes, so as to break the electrical continuity of the mains, and thus make their resistance greater than that of the rails. Fill in the space around them with broken stone and connect with drain, if possible.

(5.) Midway between the wooden sections on each main attach insulated pilot wires, leading to a central office. Connect similar wires to the rails nearest the pipe wires, and make daily electrical tests at times of heavy load. If any section shows positive to the rails cut it at once into smaller sections, and call upon the railway to rebond its line upon that street. This, with proper electrical management of the railway feeder wires and apparatus, will effectively protect your mains.

"ELECTRIFICATION" OF STEAM RAILROADS.

Prof. Sidney H. Short, who recently sailed for Europe, writes in the January *Cosmopolitan* to explain how in the next fifteen years, unless there should be an unexpected slump in electrical progress, steam will be superseded by electricity as the motive power for even the trunk-line railroads. The change will mean, he says, the reduction in time between New York and Chicago to ten hours, and a general readjustment of business and social conditions to a standard of 125 miles per hour instead of 40. This revolution will come, he thinks, without any great sacrifice in railroad properties and without radical departure from present methods of railroad construction.

The chief difficulty in the way of this great revolution is the waste which conservative railroad men always point out that it would bring to the enormous railroad plants already in operation. In the matter of locomotives alone there are now 30,000 steam engines in the United States in service, and if they only cost $10,000 each, it would mean that some $300,000,000 worth of machinery would have to be sold as scrap-iron, as they could probably not be adapted to electrical service. It has been estimated that the cost of installation of an electrical plant—conductors, locomotives, motors and cars—for a single railroad system such as the Pennsylvania would reach $100,000,000.

Prof. Short thinks that it would be much more feasible than some railroad men think to change the plant. Running over an inventory of the items in a steam railroad property of to-day, he finds a great number of the assets of a sort which would not have to be changed—real estate, office and terminal buildings, stations, round and car houses, repair shops, roadbed and appurtenances for its control and protection, passenger and freight car bodies, car-trucks, and many of the locomotives. All mentioned here, except the car-trucks and locomotives and the general repair shops devoted to locomotive work, would continue in uninterrupted use.

Prof. Short then takes the case of a railroad running by steam, and goes into the details of the cost of changing it. He suggests that as fast as a steam freight locomotive should become superannuated—and the life of such a machine is just so many years—an electric locomotive should be substituted, and thus in time the whole equipment would be changed.

Aside from the enormous advantage of greater speed, there are obvious economies in fuel and repairs. Five pounds of coal in a steam locomotive are now required to do what one and a half pounds will do in a stationary plant. The cost of fuel per HP. per hour would be brought down to a half cent, and if gas-engines were used to still less.

"The cost of repairs," Prof. Short adds, "would be enormously reduced, in spite of the greater speed obtained. Track life would lengthen with the gradual elimination of the locomotive, and repairs to a motor are both less costly and less troublesome than to a locomotive. The electric motor runs without intermission, requires little attention, and gives

an output far in excess of that demanded of any other machine in hard service. While it may not be asserted that electrical apparatus is invulnerable or that the mighty power which we drive through devious ways finds its pathway always free from obstruction, it is true that correctly designed and well-made electric railroad apparatus is of lasting utility."

"WOOD'S SYSTEM" DYNAMOS.

The following appeared in the Metropolitan Holiday Supplement of the N. Y. *Tribune*:

The West has kept pace with the progress of electrical industries, and the excellence and merit of many of the products of Western plants are fully recognized in the commercial world. Among the well-known concerns of the United States is the Fort Wayne Electric Corporation, whose machinery and apparatus are manufactured exclusively from the designs of James J. Wood. Mr. Wood has probably had a larger and more varied experience in designing electrical machinery than any other individual in the country, having devoted himself to this line of endeavor since 1867. The fact that the manufacture of apparatus by this corporation is carried on under his personal supervision is in itself a high guarantee of efficiency, excellence of electrical and mechanical design and the superior workmanship and finish which have made the product of the Fort Wayne works well known throughout the country.

The Wood constant-current dynamo for arc lighting is designed and constructed to meet the rigid requirements of central station work. It has an efficiency of 90 per cent. at full load, and is absolutely automatic in its operations. The bearings are self-oiling, and can be removed for inspection or repair without breaking a single connection or removing the armature from the machine. The regulation of this dynamo is accomplished without the aid of accessory devices. The armature is of improved design, and the commutator is large and of ample capacity.

The company manufactures direct-connected arc dynamos, with field switch of new design and construction. One of its standard types of arc machines is the eighty-light dynamo, of which the sales during the last four years have amounted to nearly fifty thousand lights capacity. It now has improvements which have lowered the maximum temperature of the armature 25 degrees centigrade, and have materially increased its efficiency. The Wood patent arc lamps are manufactured in various styles and are adapted to all purposes to which lighting may be applied. A noticeable feature of the arc lamp mechanism manufactured by this company is the extreme simplicity and ease with which they can be repaired. The new electric headlight made by the company for use on vessels or wherever a powerful beam of light may be required to be projected in all directions combines beauty of appearance with substantial construction and simplicity of operation. The electric searchlight also has many features to commend it to pilots. A specialty is made of street lamps and mast-arms, by means of which lamps may be conveniently hung over the streets where the sidewalks are lined with trees.

The Wood system of alternating machinery and apparatus has won a high place in the electrical world. During the last three or four years the compound alternators for light and power manufactured by this concern have continued to grow in public favor and its system has made friends wherever installed. The apparatus embodies a high degree of perfection and excellence of design, which has been the result of careful scientific and practical study and investigation.

As is well known, the low tension systems, on account of their great cost for conductors, are not commercially suited for supplying electric lights at a distance exceeding one-half mile from the central station, and for greater distances the alternating system is specially adapted.

Electrical experts also speak most favorably of the direct-current machinery and apparatus manufactured under the Wood system by the Fort Wayne Electric Corporation.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION.

The meeting of the special committee of the Underwriters' National Electric Association appointed to draw up specifications for wire coverings, to compile a list of fittings acceptable for use under the rules and to take up other matters in connection with the National Electrical Code, will be held at the offices and laboratory of the Electrical Bureau of the National Board at 157 La Salle street, Chicago, beginning January 9th. The committee is composed of W. H. Merrill, Jr., chairman; J. C. Forsyth of the New York Board of Fire Underwriters; E. V. French of the Associated Factory Mutual Insurance Companies; Wm. McDevitt of the Philadelphia Fire Underwriters' Association; A. M. Schoen of the South Eastern Tariff Association; J. B. Cole of the Boston Wire Department, and Edward B. Ellicott, City Electrician of Chicago. Acting with the committee will be E. A. FitzGerald of the Underwriters' Association of New York State, A. E. Braddell of the Underwriters' Association of the Middle Department, J. M. DeCamp of the Suburban Underwriters' Association, Franklin H. Wentworth, Theodore Varney, W. S. Boyd and Benjamin H. Glover of the Electrical Bureau, and a number of other officials. The manufacturers of insulated wire have been invited to be present at certain hours during the meeting when the experimental records on their products will be under discussion and the following specifications for rubber wires prepared by the Electrical Bureau will come up for action:

Wire Insulation.—(a) Rubber—Insulating compounds containing rubber must conform to or be in excess of the measurements given in the following table, which shows standard thickness of insulating walls for standard wires and cables:

B. & S.	Mils. Thickness of wall.	Mils. Diameter over rubber.	B. & S.	Mils. Thickness of wall.	Mils. Diameter over rubber.
18	.0411	.122	4	.0821	.568
16	.0437	.138	8	.0883	.406
14	.0169	.158	2	.0954	.448
12	.0512	.183	1	.1033	.493
10	.0565	.215	0	.1122	.549
8	.0631	.255	00	.1222	.609
6	.0715	.305	000	.1334	.676
5	.0764	.335	0000	.1460	.752

The above table is based upon the following formulæ, which may be applied for conductors larger than No. 0000.

Rubber diameter equals 3.2 copper diameter plus 62.

Thickness of rubber wall equals one-quarter copper diameter plus 31.

As the dielectric strength of a rubber wall is determined by its thinnest portion, all measurements shall be taken across the smallest diameter of the specimen tested. When depressions are caused by the braid or in process of manufacture, the lower surfaces of the channels caused by these depressions must be taken as the exterior surfaces of the wall. For a correct reading the measuring instrument must just shut out a line of light between the material being measured and the terminals of the instrument. All of these insulations must be protected by a substantial braided outer covering sufficiently strong to withstand all abrasion it will meet with in practice and sufficiently elastic for all wires smaller than No. 5 B. & S. gauge to admit of the conductor being wound back over itself without injury to the braid.

The completed covering must show an insulated resistance of at least 100 megohms per mile, throughout eight weeks' immersion in hydrant water at ordinary temperatures. Each foot of the completed covering must show a dielectric strength sufficient to resist throughout five minutes the application of an alternating EMF. of 16,000 volts under the following conditions: The source of alternating EMF. shall be a transformer of at least 1 kilowatt capacity. The application of the EMF. shall first be made at 4,000 volts for five minutes and then the voltage increased by steps of not over 3,000 volts, each held for five minutes until the rupture of the insulation occurs. The tests for dielectric strength shall be made on a sample of wire, one foot of which is submerged in a conducting liquid held in a metal trough, one of the transformer terminals being connected to the copper of the wire and the other to the metal of the trough.

SOCIETY NEWS.

American Institute of Electrical Engineers.

A meeting of the Institute was held at 12 West 31st street Wednesday, December 28, Mr. John W. Lieb, Jr., in the chair. A paper was read by Mr. A. A. Hamerschlag, of the New York Trade School, on the "Education of Electrical Apprentices and Journeymen." It was illustrated by lantern slides, showing the work by the electrical and other trade classes at the school. The discussion which followed was participated in by Messrs. Wetzler, Lieb, Thompson and Pope.

At the meeting of the Executive Committee in the afternoon the following Associate Members were elected:

John Allan, Sydney, N. S. W.

John Jacob Bellman, Electrical Engineer of the Crocker-Wheeler Electric Co., New York.

Robinson Crowell, Electrical Tester of the General Electric Co., Schenectady, N. Y.

Henry B. Dates, Prof. of Electrical Engineering and Physics, Clarkson School of Technology, Potsdam, N. Y.

John C. Finney, Cashier, Wisconsin Trust Co., Milwaukee, Wis.

Wm. N. Gladson, Prof. of Electrical Engineering Arkansas Industrial University, Fayetteville, Ark.

Leo Walter Hildburgh, student, Columbia University, New York.

William B. Hodge, Electrical Engineer of Elmer G. Willyoung & Co., Philadelphia, Pa.

Saitaro Oi, Chief Engineer to the Bureau of Telegraphs, Ministry of Communications, Tokyo, Japan.

Francis E. Tyng, Manager Eastern Engineering Co., New York.

Arthur J. Wood, Associate Editor *Railroad Gazette*, Brooklyn, N. Y.

Exports of Electrical Material from New York.

The following are the exports of electrical material from the port of New York for the week ending December 31:

Australia—44 cases, $3,700.
Berlin—2 cases, $200.
Brazil—33 cases, $1,748.
Bremen—1 case, $315.
British East Indies—9 cases, $210.
British Guiana—8 packages, $83.
British Possessions in Africa—1 case, $60.
British West Indies—21 packages, $663.
Central America, 189 packages, $4,838.
Cuba—35 cases, $2,441.
Ecuador—45 packages, $952.
French West Indies—1 package, $18.
Genoa—3 cases, $163.
Hamburg—121 cases, $18,359.
Hayti—5 packages, $187.
Havre—5 packages electrical vehicles $1,675.
Liverpool—57 packages electrical material, $2,063.
London—1 case electrical instruments, $550; 116 cases electrical machinery, $3,800; 16 cases electrical material, $612.
Manchester—1 case, $300.
Marseilles—2 cases, $100.
Milan—1 case, $20.
Peru—18 packages, $341.
Santo Domingo—4 packages, $45.
Siam—11 packages, $574.
Venezuela—278 packages, $698.

LEGAL NOTES.

At Harrisburg, Pa., on the 27th ult., Judge McPherson handed down an opinion in the case of the Commonwealth of Pennsylvania vs. the Keystone Electric Light, Heat & Power Company of Gettysburg, in which he orders judgment to be entered against the defendant company, that it be ousted and altogether excluded from exercising the franchise of the Electric Light, Heat & Power Company of Gettysburg, and also from the franchise or privilege to be a corporation by the name of the Keystone Electric Light, Heat & Power Company or by any other name.

An electric passenger railway on a country highway is held in Zehren vs. Milwaukee Electric Light & Railway Company (Wis.) 41 L. R. A., 575, to constitute an additional burden which requires the consent of the abutting owner and payment of compensation.

The Havana City Railway Company has brought a suit in New York against J. M. Ceballos, F. R. Robl, Francisco Pla and the American Indies Company, to compel them to turn over to the railway company the franchises for constructing the street railways in Havana. On Friday last J. J. Adams, representing Ceballos and Robl, made a motion before Judge Scott to compel Kisch & Roberts, attorneys for the plaintiffs, to disclose their authority for bringing the suit, and also to state where Hugh Alexander and Eugene Sweeney, two of the members of the Havana Street Railway Company, reside. Mr. Kisch, in his argument, said that Alexander was a resident of East Orange, N. J., and that Sweeney resided in New York City. He stated that the Havana Street Railway Company was a duly organized company and had spent considerable money in perfecting plans, etc., for constructing a street railway in the Cuban city, but that upon the outbreak of the war the work had been abandoned for the time being. He said that Mr. Ceballos had in his possession the papers transferring the franchise from the original owner, Francisco Pla, to the Havana Street Railway Company, and that since the end of the war he, with others, had organized the American Indies Company with a capital of $18,000,000, and that it was the new company's intention, if possible, to get control of the franchises. Judge Scott reserved his decision.

THE NEWS.

What is Going On in the Electrical World.

LIGHTING.

Albany, N. Y.—The board of supervisors has adopted a resolution empowering the military committee to make an investigation of the proposition to equip the armory and public buildings with a suitable electric lighting plant.

Cincinnati, O.—City Electrician Klein is at work on a plan which will revolutionize the repair of sewers. He is perfecting a portable mechanism for lighting large sewers with incandescent lights so that a stretch of about 2,000 feet can be lighted at once if necessary. The idea is to use a pole line, or an independent portable battery. The use of torches for illumination has been found to be a fearful strain on the men. A short stay in the sewer, breathing the torch smoke, causes great suffering to them. The sewers also contain gasoline, which is discharged from dye houses, and this is liable to be ignited by the torches and cause explosions.

Cuero, Tex.—The Buchel Power & Light Company has bought the plant of the Cuero Electric Light & Power Company. This puts an end to the light fight that has been on for some time.

Dayton, O.—A resolution passed by the city council on the 23d ult. directs the city engineer to report an estimate of the cost of constructing an electric light plant in Dayton, including the cost of machinery, engines, boilers, buildings, poles, wires, lamps, etc. It is proposed at the April election to submit to the voters the question of issuing bonds for the purpose of constructing a plant of this character.

Glassboro, N. J.—The Gloucester County Electric Light Company has been granted the privilege of furnishing electric light to the township of Glassboro by the township committee. The township is at present using old coal-oil lamps, and the citizens are jubilant over the assurance of electric illumination.

Great Bend, Kan.—The residents of this place are in a bad fix, outsiders say—they have no lights and no beer. They ought to straighten up and get lights at all events.

Henderson, Tenn.—The electric light plant has been in operation for two weeks and nearly all the citizens are liberal and substantial supporters of the company. The business houses and many residences are lighted.

Humboldt, Ia.—On the 23d ult. this town voted to permit a home electric lighting plant to be put in for the full limit of the law, twenty-five years. The majority was large.

Ogden, Utah.—The proposition of the Union Light & Power Company to furnish street lights for the coming two years has been accepted and the contract approved.

Pierre, S. D.—The city has concluded a deal by which it gets control of the electric light plant, which has heretofore been conducted by a private corporation.

Pittsburg, Pa.—Morris W. Mead, superintendent of the Bureau of Electricity, is busy at present rearranging the rules governing electric light inspection. He says there are so many kinds of manufacturing establishments in Pittsburg where acids are in use that it has been found necessary to change certain of the rules in order to meet all local cases. All the ordinances and resolutions that have been passed and which bear on the subject will be incorporated in the new rules.

Portland, Ore.—The construction committee of the Water Committee has been instructed to ascertain the probable cost of installing and maintaining an electric plant of sufficient capacity to light the city. The city now uses 703 arc lights of 2,000 candle-power each and 637 incandescent lamps of 25 candle-power each. The construction committee consists of Messrs. Corbett, Dolph, Therkelsen, Teal and Lowenberg.

Savannah, Ga.—The Edison Electric Light Company, which proposes to put in a new plant in Savannah, has within the last week or two made strong efforts to get control of the stock and plant of the Brush Electric Light Company, the only company which has a plant in the city. The stock has been selling on the market at about 70, but the Edison company has offered as high as 90 for 90 per cent. of the stock. The Edison Company has been endeavoring to get a foothold in Savannah, and the outside gossip is that they were convinced that there was not business enough in the city for two lighting and power companies.

St. Helena, Cal.—The board of town trustees has granted a franchise to the St. Helena Light & Power Company permitting it to erect and operate an electric light plant in this town. It is expected that the plant will be in running order early in April.

STREET RAILWAYS.

Albany, N. Y.—The Albany Construction Company, W. H. Schermerhorn, of Brooklyn, president, incorporated for the express purpose of building the Albany, Helderberg & Schoharie Electric Railway Company's road, is now ready to sublet contracts for rails, ties, material, etc. The work of construction will be begun as soon as the weather permits. A survey has been filed with the county clerk and another copy of the proposed route will be filed with the board of railroad commissioners.

Biddeford, Me.—A contract has been entered into with Isaac A. Walker & Son of Philadelphia for the building, equipping and operation early next summer of the Saco River electric railroad from the Biddeford line to Bonny Eagle in the town of Standish. The road is expected to be first-class in every particular.

Carrollton, Ky.—An Eastern firm has guaranteed the building of the Carrollton electric railway. The greater portion of the $75,000 necessary to build a bridge across the Kentucky river has been procured.

Frederick, Md.—Several of the incorporators of the Frederick, Thurmont & Northern Electric Railway have arranged to meet some well-known capitalists in Baltimore, when an effort will be made to interest them in the construction of the road. From Baltimore the incorporators expect to visit Washington for the purpose of having an interview with the promoters of the proposed electric line from Washington to Gettysburg by way of Frederick.

Hartford, Conn.—A large number of petitions will be presented to the incoming Legislature for new trolley roads or extensions. The present mileage of trolley roads in Connecticut is a little over 490, and the projects set forth in the new petitions represent about 300 additional miles, of which about 140 miles, if built, would parallel steam roads. The proposed parallels are a new line from Hartford to New Britain, three lines from New Haven to Derby, two lines from Middletown to Hartford, and lines from Hartford to Winsted, from Naugatuck to Beacon Falls, from Ansonia to Seymour, from New Haven to Wallingford, from Norwich to New London, and from Southington to Waterbury, Mount Carmel, Plainville, and through certain streets of Meriden. At least eight of these schemes are sure to encounter resistance from the New Haven Railroad Company.

Kokomo, Ind.—Charles L. Harry, superintendent of the Kokomo Street Railway Company, has filed petitions with the commissioners in Tipton and Hamilton counties, asking for the right-of-way and the privilege of building an electric railroad extending from Tipton south through Atlanta, Arcadia and Cicero to Indianapolis. E. H. Shirk, president of the Tipton National Bank, is also interested in the proposed road.

Louisville, Ky.—James G. Wright, secretary of the Louisville, Mt. Washington & Fairfield Electric Railroad, which is as yet in process of development, has addressed a communication to the Mayor, asking him to request the Board of Works to take action on his petition for right-of-way through certain streets in this city.

Plainfield, N. J.—The city council at its meeting on the 20th ult. granted a franchise for the last connecting link in the trolley system which will connect New Brunswick and Newark. In the contemplated system of trolley extension from Philadelphia, Newark, New Brunswick, Somerville and Plainfield are now connected by trolley, and the franchise has been granted from Plainfield to Elizabeth. The franchise just granted is for less than a mile, but has been a bone of contention since last summer.

Pontiac, Mich.—The township board of Rochester has granted a franchise to John Winters and O. H. Lau of Detroit for an electric railroad to this city, this branch to make connections with the proposed line to Orion, of which Messrs. Winters and Lau are the promoters. A line will be run from Detroit to Rochester if present indications materialize. The Rochester line will connect with the Orion-Pontiac line about one-and-a half miles south of Ball Mountain.

Wadsworth, O.—Attorney George D. Hile, of Cleveland, representing the Cleveland, Wadsworth & Southern Street Railway, has asked the council for a franchise to build and operate a street railway in Wadsworth and to furnish power, light and heat and telephone service.

MANUFACTURING, ETC.

Chicago.—The Fisher Equipment Company of this city is reported to have entered into a contract to furnish $1,000,000 worth of electrical vehicles, to be sold in Europe in the next ten years. Count de Jotemps of Paris, president of the American Motor General Agency of Paris, negotiated the deal for his company. Count de Jotemps says that his company will open its Paris office on the Champs Elysees on March 15, and will soon establish branches in London, Berlin, Vienna and Brussels. His company has a capital of $2,000,000. The first shipment of vehicles from Chicago will be made this month.

Providence, R. I.—The "Telegram" learns from Mr. Eugene Phillips of the American Electrical Works that the great wire trust which has been reported for some months as in process of formation is now an accomplished fact or will be on the 10th of January, and that the name of the concern will be the American Steel & Wire Company. Mr. Phillips says the trust will not have any great effect on the manufacture of wire in Rhode Island, as the class of goods turned out by the American Electrical Works is much smaller than that which the new combination desires to control. The biggest concern in the East which has entered the combination is that of the Washburn & Moen Company of Worcester.

Syracuse, N. Y.—The Crouse-Hines Electric Company of this city doubled its capacity during the past year in the way of additional space, new machinery and a larger force of men. Employment is now given to forty-five persons and the plant is kept in operation every night until 9 o'clock. High grade electrical apparatus is turned out by this company and extensive sales are made in all parts of the United States and Canada. The company believe that the situation warrants further enlargement of their business and an effort will be made to increase the capacity to a further extent the present year.

Washington, D. C.—The British Government has extended an invitation to the United States to take part in the Western Australian International Mining and Industrial Exhibition which is to be held at Coolgardie in March, 1899, under the patronage of the Government of Western Australia. The opportunity afforded to American exhibitors is one of especial value and importance in view of the fact that Western Australia, by its rapid development, its great resources, and its unlimited prospects, affords exceptional openings for American goods. The Exhibition will be intercolonial in its character, and will be attended by many visitors from the whole of Australasia. The following, among other classes of manufacture, will find special scope for exhibition, and, if so desired, of sale, viz: Electric motors, lighting apparatus, wire, and electric appliances of various kinds. The Exhibition will be opened on March 21, 1899, and continue open for a period of at least three months.—The attention of the electrical industry is also called to the fact that a Provincial Exposition of East Flanders will be held at Ghent during the summer of 1899, being opened June 14. While the principal exhibits will naturally be made by the residents of the province, there will be a department for foreign exhibitors. The Exposition will furnish the best opportunity ever offered to introduce our electrical goods to the markets of Ghent and the Flanders, and is worthy the attention of American manufacturers and exporters.

POWER AND TRANSMISSION PLANTS.

Bridgeport, Conn.—The Housatonic Power Company has given notice that it will petition the General Assembly for an amendment to its charter, giving it the right to build a dam across the Housatonic river between the towns of Bridgewater and Brookfield, at or near the village of Southville, and the right to conduct electricity from New Haven County to points within Hartford County. It is the intention of the company to obtain power from the waterfall, to be created by the construction of one or more dams, for the purpose of generating electricity.

Helena, Mont.—The big dam and power house at Canyon Ferry, on the Missouri River, sixteen miles

from Helena, have been completed, and electric current, transmitted from the plant to this city, is now supplying power to many industries in the city and vicinity. In the construction of the dam the labor of 250 men was required for two full years, at a cost of half a million dollars. In it were consumed 3,000,000 feet of timber, 45,000 cubic yards of earth and 50,000 cubic yards of granite, quarried at the dam site. Four large penstocks about 50 feet long and 45 inches in diameter, each containing water wheels revolving at the rate of 147 times per minute, furnish the primary power, which is equivalent to about 12,500 horse power, but this may be increased in the ratio of four to ten, or 31,250 horse power, should the occasion so demand.

Minneapolis, Minn.—The St. Anthony Falls Water Power Company has closed a contract with the General Electric Company of New York for completing the equipment of its power house at the lower dam with electrical machinery. The new equipment will probably be ready for use by July 1, and the new power created will be used for street railway purposes and for general use by manufacturing plants throughout the city. The power plant will then be of a capacity of 10,000 horse-power at a low stage of water, all of which is created and run by the water power developed at the lower dam, and is in addition to nearly three times that amount of power which had already been developed and was in use at the upper dam.

Richmond, Va.—The Virginia Electric & Development Company, of which J. C. Todd, of Baltimore, is president, is ready to proceed with the project for electrifying James river here. The common council of Richmond has concurred in an ordinance passed by the upper branch authorizing the Virginia Electric Company to transfer its franchise for this purpose to the new corporation, or, as a matter of fact, change the name of the same. The $5,000 bond given by the old concern was also transferred to the new one. The parties interested in the Virginia Electric Company are the same as those in the corporation which succeeds it.

Pittsburg, Pa.—Details of the plan of the Miller Electric Construction Company for utilizing the power of the falls of Niagara are given in the Pittsburg "Post." In the first place it is expected to erect a large building, 600 feet long and 100 feet wide, which is to be moored and securely fastened in close proximity to the falls. The structure is to be built of metal, its principal feature being structural iron and steel. The building is to be six stories high, and will have a floor space of 360,000 feet, or 60,000 feet on each floor. The interior is to be used for manufacturing purposes. The entire bottom will be constructed of steel plate. It will have another bottom constructed of vacuum copper cans, each of which will be two feet square. It is proposed to pump these full of air to give the building sufficient buoyancy. It will be kept in place by a system of anchors and heavy iron cables. The current at the point where the building is to be located is not swift, it being what is known as a back current, and will assist in keeping the building in proper position. From the end of the building next to the falls are to project huge structural steel arms, 150 feet long, which swing up and down on a pivot. On the end of the arms are to be placed turbine wheels 12 feet wide, with a diameter of 18 feet, which will be thrust into and be operated by the falling water of the cataract. On the end of the building a tower 150 feet high will be erected. The position of the arms and the entire machinery will be regulated from this vantage point. From the turbine wheels to the building there will be a system of endless chains which will be connected with a large shaft and countershaft. With this it is expected to put the most powerful dynamos, of any required number, in motion. The width of the building will allow the construction of 12 turbine wheels which would give more power than is ever expected to be needed.

Visalia, Cal.—The Mount Whitney Power Company, a company which intends to harness the waters of the Kaweah River, develop electric power and transmit the same to Visalia, Tulare, Porterville, Exeter and Lindsay, is making progress in its great enterprise. The route of the flume for a distance of one mile and a half has been cleared and active work on its construction will soon be commenced. The construction of the flume and power house will proceed simultaneously. Everything that enters into the construction of this gigantic enterprise will be first-class in every particular. Only the best and latest improved electrical machinery will be utilized. The company has awarded the contract to supply the copper wire for the power lines. The company expects to be ready for business early in the spring.

COMPANY MATTERS.

Dallas, Tex.—The receivership proceedings instituted against the Dallas Electric Company by the United Electric Securities Company of Boston have been dropped. By mutual agreement between the Securities Company and the Fort Wayne Electric Corporation all interests of the Fort Wayne company and of R. T. McDonald have passed into the control of the United Electric Securities Company. The management passes into Boston hands. The new company has the following officers: President, Walker Abbott of Boston; vice-president, W. H. McGrath of Dallas; secretary and treasurer, John Frost. The directory is composed of the president, vice president, secretary and treasurer and Robert Treat Paine and Gordon Abbott, both of Boston.

Dolgeville, N. Y.—Senator-elect James D. Feeter of Little Falls has been appointed permanent receiver of the Dolgeville Electric Light & Power Company. It is understood that the company is now making considerably more than its expenses.

St. Louis.—John H. Blessing, secretary and one of the directors of the Central Traction Company, is reported in the "Star" as saying that a deal involving the sale of the Central Traction Company's interests in St. Louis to Brown Bros. of New York, acting for a syndicate, had been consummated. The Central Traction Company holds a valuable franchise for street car lines in the city, but as yet has none in operation.

PERSONAL AND MISCELLANEA.

Lieutenant-Commander S. Dana Greene of the New York Naval Militia has been detailed as an aide on the staff of Governor Roosevelt. Lieutenant-Commander Dana entered the United States Naval Academy in June, 1879, and graduated at the head of his class in June, 1883. He was commissioned ensign two years later but resigned from the navy in 1888. Three years afterwards he joined the Naval Militia. At the outbreak of the war with Spain he re-entered the United States Navy, being appointed junior lieutenant. He served on board the lively cruiser Yankee during the Santiago campaign and was honorably discharged on September 6. He was subsequently reappointed lieutenant-commander and chief of staff of the captain of the Naval Militia. Lieut.-Com. Greene is well known in electrical circles as an official of the General Electric Company.

Edward M. Hayward, an electric light trimmer in the employ of the Worcester Electric Light Company, was electrocuted a few days ago while at work trimming a lamp at the Holyoke Machine Works in Worcester, Mass. The current had not been turned off, and standing on damp ground, without gloves on his hands, the unfortunate man received a shock which caused his death within a few minutes. Hayward had been in the employ of the company for seven years and was regarded as a faithful workman, but as in the case of railroad brakemen, he had become so accustomed to face danger that he gradually neglected the usual precautions and so lost his life.

The employes of the Newport News & Old Point Railway & Electric Company, formerly the Newport News, Hampton & Old Point Railway Company, were treated to a startling surprise on Christmas eve by the president of the old company, J. S. Darling. The men were summoned to be at the power house in Newport News at 1 o'clock A.M., and to a man they expected to receive their discharges from the new management. They were astonished to find waiting for them there checks for varying sums, the gift of Mr. Darling and his son, who sold out to the new company. The sum of $16,000 was divided among thirty employes, the amounts of the checks being based on the time of service. One man received a check for $1,000, several conductors received each $750, others received $400 and $500, and the rest amounts large and small. The old president, who is one of the richest men in that section of Virginia, made a speech to the men, some of whom were moved to tears at his generosity.

A few nights ago in Brooklyn, the fuse box of a trolley car burned out, the lights were extinguished and the car came to a standstill. Investigation showed that the trolley pole had become entangled with the "L" road structure. Most of the passengers, many of whom were women, fled from the car in fright and stood about it. The motorman found that the accident was due to the loss of a pin from the wheel on the end of the pole, and after surveying the situation begged the women standing about for three hairpins. With two of these he repaired the fuse box and then climbing on top of the car replaced the wheel and put in the other hairpin in place of the missing cotter pin. It answered the purpose, and after a half hour's delay the car went on its way as far as the barns, where it was taken off for repairs.

At mines where electric plants are installed for the operation of coal cutting machines, locomotives, drilling and so forth, the application of electric motors is constantly being extended and applied to apparatus which a few years ago presented no encouragement for the electrical engineer. The least encouraging of these was the coke oven "larry," says "Mines and Mining." Due to the conditions under which the "larry" has to operate it does not seem advisable to attempt to use an electric motor to propel it along the coke ovens. There was apparently no advantage to be gained by reduction in expense of operation, and the owners of coal mines operating coke ovens were not encouraged to adopt this means of propelling the "larry." Subsequent experience has shown, however, that the device is economical and practical, as was demonstrated by the adoption of the system at the mines of the Pulaski Iron Company in West Virginia, making a locomotive out of it and entirely doing away with the use of mules about the coke ovens. The increased rate of travel allows the ovens to be charged more rapidly, and a less number of larries are required than when mules are used.

RECENT COMPANY ELECTIONS.

Albany, Helderberg & Schoharie Electric Railway Company, Albany, N. Y.—President, H. W. Burgett of Brookline, Mass.; vice-president, B. M. Secor, Albany; secretary, William H. Irwin, Albany; treasurer, Charles E. Bibbew, Boston, Mass; directors: H. W. Burgett, B. M. Secor, R. J. McCauley, Thomas J. Wood, Berne; E. Twitchell, Schoharie; H. W. Smith, W. H. Irwin, James M. Borthwick, Charles H. Brown, Rufus H. Sawyer, O. L. Brown, Boston; O. F. Plank, Gallupville.

Albion Electric Light Company, Albion, Mich.—President, E. P. Robinson; vice-president, A. J. Galo; secretary, A. N. Foote; treasurer, W. O'Donoghue; manager, W. A. Foote.

Chattanooga Terminal Railway Company, Chattanooga, Tenn.—President, T. J. Nicholl; vice-president, Frank Spurlock; treasurer, John Orr; secretary, H. C. Beck; directors: the officers and W. G. M. Thomas.

New Orleans City & Lake Railroad Company, New Orleans.—President, Albert Baldwin; president pro tem., R. M. Walmsley; secretary, A. H. Ford; directors: Albert Baldwin, R. M. Walmsley, Frank T. Howard, A. B. Wheeler, C. H. Hyams, J. C. Denis, C. M. Soria, O. Eustis, John W. Castles, R. E. Craig, J. B. Levert, E. G. Schlieder.

People's Electric Light & Power Company, Oswego, N. Y.—President, E. H. Bennett; vice-president, D. L. Couch; treasurer, J. O. Knight; secretary, Allen O. Casler. The officers and C. W. Ott form the board of trustees.

Portsmouth & Dover Railroad Company, Portsmouth, N. H.—President, Frank Jones; treasurer, A. F. Howard; clerk, Calvin Page; assistant treasurer, John W. Emery; directors: Frank Jones, J. Albert Walker, John S. Tilton, Portsmouth; Joseph O. Hobbs, North Hampton; Daniel W. Lawrence, Medford, Mass; Frank A. Christie, William D. Sawyer, Dover.

COMMERCIAL PARAGRAPHS.

Calendars, Etc.

The 1899 calendar of the American Electrical Works, Providence, R. I., which has come to hand, contains an engraved likeness of Prof. Morse set in the ornamental lettering of the company's name. The card as a whole is plain and yet elegant—neat but not gaudy—and in this respect fitly represents a company noted for the sterling quality of its productions and the faultless taste evinced in everything it prints for circulation.

The Okonite Company's calendar is quite pretty. Framed in the gray card to which is appended the monthly notations is a daintily colored lithograph of a handsome French peasant girl, whose arms are loaded with baskets containing sundry products of the farm and dovecote. While pursuing her way to Paris, as we assume, she is attacked by a vicious terrier who has seized her dress in front and is tugging at it with all his strength and with possibilities of disastrous effect which an uplifted umbrella in the hands of the girl inspires the hope may be happily averted. In the meantime some of the doves, taking advantage of the situation, are making their escape from one of the baskets. The moral we suppose is, that Okonite, like the umbrella, can always be relied upon no matter what threatens.

The Standard Underground Cable Company have kindly sent us, with their good wishes, a combination foot rule and wire gauge, which we shall not only prize for its usefulness, but shall preserve as a reminder that the company is still "on the earth" though engaged so extensively in underground undertakings in all parts of the habitable globe wherever a standard wire or cable is used for transmission of electric current.

The Lombard Water Wheel Governor Company, whose office and factory are at 61 Hampshire street, Roxbury District, Boston, Mass., report that the demand for their governors is constantly on the increase. During last month they received orders for upwards of twenty governors to regulate forty-one water wheels which will develop 15,710 horse-power. More than half of this machinery will be used in electric stations—principally in power transmission plants—and electric railway stations, the balance being in textile and other manufacturing plants driven by water power.

The Electric Appliance Company, Chicago, have for distribution to the telephone trade a sample card of such of their celebrated Paranite Wires as are particularly adapted to telephone uses. The card shows samples of No. 19 plain and braided Single Conductor Paranite of a high insulation suitable for telephone work. It also shows samples of No. 19 Duplex Twisted Paranite Wire in three styles, the first being plain with one conductor of red rubber and the other with black rubber insulation; another sample with black and red rubber insulation but braided over with a regular saturated weather-proof braid. There is still another sample of the No. 19 two conductor twisted having red and black rubber insulation, but having glazed braid instead of the saturated braid. These sample cards can be had for the asking.

INCORPORATIONS.

The Canadian Electric Extract Company, Portland, Me. —to manufacture extracts. Authorized capital, $10,000; subscribed and paid, in $70. Incorporators: G. D. Burton, Boston, Mass.; D. H. Williams, Somerville, Mass.

The Richmond Electric Company, Richmond, Ky.—to manufacture all kinds of electric appliances. Capital stock, $10,000. Incorporators: J. W. Cook and others.

The People's Street Railway Company, Chicago, Ill. Capital stock, $10,000. Incorporators: J. W. Latimer, B. R. Reynolds, J. G. Latimer.

The American Electrical Extract Company, Portland, Me.—to manufacture extracts. Authorized capital, $3,000,

000; subscribed and paid in, $60. Incorporators: G. D. Burton, Boston, and L. H. Williams, Somerville, Mass.

The Milo Electric Light & Power Company, Milo, Me.—to supply light, heat, etc., in the towns of Milo, Sebec and Brownville. Capital stock, $10,000. President and treasurer, Julian D'Este, Dover, Me.

The Cuban Electric Company, Asbury Park, N. J.—to manufacture electricity for light, heat and power. Capital stock, $1,000 000. Incorporators: William R. S. Melvin, East Orange, N. J.; G. K. B. Wade, Herbert A. Howell, Henry K. Davis, New York; Francis A. Fuller, Brooklyn.

The South American General Electric Supply Company, Schenectady, N. Y.—to buy electrical apparatus in the United States and sell it in South America. Capital stock, $50,000. Directors: S. D. Greene, H. W. Darling, D. Mazenet, J. R. Lovejoy, M. F. Westover, Schenectady, N. Y.

The San Juan & Rio Piedras Railroad Company, New York—to construct and operate an electric or steam railroad, 7½ miles long, from San Juan to Rio Piedras, Porto Rico. Directors: George H. Walbridge, Fernando G. Echeveddia, H. H. Harrison, Edward Schmidt, Lathrop R. Bacon, F. Kingsbury Curtis, Philip H. McMillan, Augustin N. Hand and William B. Parsons of New York City.

The Electric Power Development Company, Camden, N. J.—to manufacture and supply electricity to municipalities, etc. Capital stock, $500,000. Incorporators: Marcus B. Taylor, Charles W. Kennedy, Isaac Blum, Wm. Findlay Brown and S. Y. Heebner.

The Electric Mining & Reduction Company, Portland, Me.—to manufacture electrical mining apparatus and do a general mining business. Authorized capital, $500,000; subscribed and paid in, $7. Incorporators: E. K. Milliken, Deering; G. D. Burton, Boston; Charles Williams, Jr., Somerville, Mass; L. H. Williams, Brookline, Mass.; George Wallace, Newtonville, Mass; G. W. Stiner, Brooklyn, N. Y.; A. Scidmore, Gloversville, N. Y.

The Canadian Electrical Process Company, Portland, Me.—to manufacture electrical leather-working apparatus. Authorized capital, $10 000; subscribed and paid in, $70. Incorporators: E. K. Milliken, Deering; G. D. Burton, C. H. Kimball, Boston; H. M. Tower, Spencer, Mass.; Charles Williams, Jr., Somerville, Mass; L. H. Williams, Brookline, Mass; George Wallace, Newtonville, Mass.

The Burton Electric International Leather Company, Portland, Me.—to manufacture electrical leather-working apparatus. Authorized capital, $10,000; subscribed and paid in, $70. Incorporators: E. K. Milliken, Deering; G. D. Burton, C. H. Kimball, Boston; H. M. Tower, Spencer, Mass.; C. Williams, Jr., Somerville, Mass; L. H. Williams, Brookline, Mass.; George Wallace, Newtonville, Mass.

ELECTRICAL PATENT RECORD.

LETTERS PATENT ISSUED DECEMBER 27, 1898.

ELECTRIC RAILWAYS AND RAILWAY APPLIANCES.

616,821. Underground Electric-Railway System. Frederick H. Chamberlain and Griffin B. Coleman, Washington, D. C. Filed Dec. 2, 1897.

616,701. Fender for Street-Cars. Theodore C. Forbes, Chicago, Ill. Filed July 18, 1898.

ELECTRIC LIGHTS AND APPLIANCES.

616,507. Incandescent-Electric-Lamp Socket and Base. Christopher Van Deventer, New York City. Filed April 1, 1898.

616,607. Support and Take-Up Device for Cable-Suspended Electric Lamps. John H. Dorion, Springfield, Mass. Filed June 13, 1898.

616,620. Electric Incandescent Lamp. Henry F. Joel and Ferdinand Fanta, London, England, assignors to the Improved Electric Glow Lamp, Limited, same place. Filed July 29, 1896.

616,770. Lighting or Extinguishing Automatically Incandescent Electric Lamps. Charles S. Cole and John H. Kinsman, Bridgeport, Conn. Filed April 1, 1898.

616,779. Electrical Safety-Lamp for Miners. Carl Francke, Berlin, Germany. Filed April 18, 1898.

ELECTRICAL MACHINERY AND APPARATUS.

616,519. Mold for Forming Armature-Coils. William K. Bassford, Jr., Bound Brook, N. J. Filed July 27, 1898.

616,673. Electric Motor and Method of Controlling Same. Charles W. Kennedy, Rutledge, Pa., assignor to Samuel Y. Heebner, same place. Filed April 22, 1898.

616,861. Automatic Weighing-Machine. Francis H. Richards, Hartford, Conn. Filed Dec. 10, 1897.

616,862. Weighing-Machine. Francis H. Richards, Hartford, Conn. Filed Dec 13, 1897.

616,863. Weighing Machine. Francis H. Richards, Hartford, Conn. Filed Dec. 15, 1897.

TELEPHONE AND TELEGRAPH APPARATUS.

616,714. Automatic Telephone-Exchange. Frank A. Lundquist, John Erickson and Charles J. Erickson, Lindsborg, Kan. Filed March 28, 1898.

616,718. Telephone Gravity-Switch. Charles T. Mason, Sumter, S. C., assignor to the Telephone Manufacturing Company, same place. Filed May 3, 1898.

616,755. Binding-Post for Electrical, Telephonic or Telegraphic Instruments. Joseph A. Williams, Cleveland, O., assignor to the Williams Electric Company, same place. Filed May 25, 1898.

MISCELLANEOUS.

616,513. Apparatus for Making Observations by Means of Roentgen or X-Rays. Jacques Wertheimer, Paris, France. Filed Nov. 19, 1897.

616,612. Armored Electric Cable. Edwin T. Greenfield, New York City. Filed April 13, 1898.

616,669. Recording Device for Measuring Instruments. Adrian H. Hoyt, Penacook, N. H. Filed Aug. 13, 1897.

616,722. Railway Signaling Device. Francis M. Myers, Windsor, Mo., assignor of one-half to Charles A. Draper and Joseph S. Calfee, same place. Filed April 2, 1898.

616,801. Electric Heater. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed Oct. 13, 1898.

DESIGN.

29,891. Front Plate for Electric Heaters. Edward E. Gold, New York City. Filed Oct. 25, 1898.

TELEPHONE AND TELEGRAPH.

Independent Telephone Movement.

"Occasionally the people of Chicago are reminded," says the Chicago *News*, "that elsewhere an earnest effort is being made to break the power of the old telephone monopoly, although that institution is as formidable in this city to-day as at any period in its history. While the local Bell company is complacently increasing the rates for those who cannot tolerate the defective service provided by the antiquated 'ground-return' system and are therefore compelled to pay an additional fee of $50 for complete metallic-circuit instruments, the Bell interests at other points are confronted by determined opposition.

"It cannot now be said that the independent movement is confined to small places, for companies have been organized and service is being given in many large cities. In St. Louis, for instance, the Kinloch Company has more paid subscribers on its list than the Bell Company has ever had in that city, and the Kinloch has only recently completed its system. The new service is pronounced satisfactory in every respect and the rental is only $60 per year. A similar system is now being introduced into Indianapolis, and Cleveland is working along similar lines. Detroit has long had an independent company, which outranks the Bell concern in importance, and other towns have found the independent service far preferable to the old order. In New York the Board of Trade and Transportation, which has been fighting the Bell monopoly for years, has pledged its support to an independent company. Boston has just granted a franchise to an anti-Bell corporation which agrees to furnish first-class service at a maximum rental of $72 per year. It is claimed by conservative telephone experts that $75 per year would be a fair rental for modern telephone service in Chicago."

S. P. Sheerin, one of the chief promoters of the New Telephone Company, who had been in attendance at the meetings of the independent telephone exchanges of Eastern Illinois and Western Indiana, at Paris, Ill., on the 21st ult., returned to Indianapolis accompanied by A. F. Ramsey and George W. Beers, representing the associated independent telephone lines of Indiana. The object of the Indiana men at the meeting was to secure an agreement by which the toll business would be interchanged between the Illinois and Indiana independent lines. The Illinois lines represented at the meeting controlled 10,000 telephones and about 2,000 miles of toll lines. During the meeting representatives of the Central Union and Bell Telephone companies made overtures similar to those rejected by the Indiana independent companies at Lafayette. None of the propositions were received with favor and, after short speeches against making any arrangement with the old companies, were rejected. The following exchanges were represented at the meeting: Oakland, Kansas, Mattoon, Sullivan and Cole county, Hume, Sidel, Clinton and Danville, Ill; Chrisman and Dana, Ind.; Ridge Farms, Paxton, Watseka, Hoopeston, Paris and Charleston, Ill., and the Citizens' of Terre Haute, Ind.

"The fact is well deserving of note," says the *N. Y. Sun*, "that at one of its recent meetings the Franklin Institute of Philadelphia awarded the Longstreth medal to Thomas B. Doolittle, well and widely known in telephone circles for his hard-drawn copper wire, a most important contribution, it is hardly necessary to say, to all electrical industries. This wire, while retaining those properties of conductivity inherent in copper, has the additional quality of great tensile strength, and it is the opinion of those qualified to judge that, without this discovery, long distance telephony and the electrical transmission of energy over long distances would be impossible—in a word, the value of this process and its extensive application is sufficiently evident from the fact that the annual consumption of hard drawn copper wire in the United States alone exceeds eighty million pounds. With the caution demanded by the subject, the Franklin Institute waited until it had made an exhaustive examination of the case, and until the value of the discovery had been amply proved."

In the Circuit Court at Baltimore on the 28th ult., Judge Wickes signed a decree for the sale of the property of the Home Telephone & Telegraph Company in Baltimore. It provides that the sale shall take place after three weeks' notice by advertisement, and that no bids less than $125,000 shall be received. The operation of the decree was suspended by the Court until January 2, by which time it was hoped that arrangements for the reorganization of the company might be made by the stockholders. The upset price of $125,000 named in the decree, it is said, exceeds the company's liabilities, including its bonded indebtedness, with interest, of $90,000. The Home Company operates the only opposition telephone service in Baltimore and has upwards of 1,500 subscribers.

At Des Moines, Ia., the city on the 23d ult. filed a petition in the District Court asking for an injunction to restrain the Iowa Telephone Company from building additional lines in the city, and for an order directing that all poles and wires of the defendant company be removed from the streets and alleys of the city at the cost of that company. The city claims that the Iowa Telephone Company is operating without a franchise. Judge Holmes, to whom the petition was presented, has issued an order directing the defendant to appear at 10 A.M. on January 9 and show cause, if any, why a temporary injunction shall not issue.

The N. Y. *Commercial* of the 30th ult. says: "The Merchants' and Manufacturers' Board of Trade, which has its headquarters in the Hoffman House, through its Telephone Committee will launch next week a crusade against extortionate rates, which is designed to bind together all the telephone-reform associations in the United States, to sow the seeds of other associations, and to bind them all into a league of great power and influence. The members of the Telephone Committee are O. C. Shayne, Andrew Patterson, Francis O'Neill, Charles Hickman, C. Du Brull and J. A. Hickman, secretary of the Board, all prominent business men.

A press dispatch from Tuscola, Ill., dated the 1st inst., states that the Bell Telephone Company has just succeeded in absorbing the Interstate Telephone Company, which had headquarters in Tuscola. The Interstate Company, the dispatch states, owned and operated several hundred miles of lines in Central Illinois, and as the Bell Company threatened to cover the same territory a compromise was effected whereby the Interstate goes out of existence.

The Chicago *Economist* says that John D. Rockefeller of the Standard Oil Company is interested to the extent of over $500,000 in the new Home Independent Telephone Company of Cleveland, Ohio, which is being promoted by H. A. Everett. Mark Hanna is also reported to be heavily interested in the project.

Major Dunwoody of the Signal Service has arrived in Havana and has been ordered to report for duty as Chief Signal Officer on General Brookes' staff. He will have charge of all telegraph and telephone lines in Cuba, and the island's business in this line will be run by the Government during the military occupation.

The New Haven (Conn.) *Commercial Register* states that S. Harrison Wagner and ex-Governor Waller are mentioned as being interested in the plans on foot to establish a new telephone company as a rival corporation to the Southern New England Telephone Company.

At a recent special meeting of the board of mayor and aldermen of Asheville, N. C., an order was issued, restraining the Bell Telephone Company from interference with the Asheville company in the work of putting in a new telephone system.

The Duluth Telephone Company's new telephone line between Duluth, Carleton and Cloquet, Minn., was formally opened on the 21st ult. It affords long distance service.

Albert B. Chandler, president of the Postal Telegraph & Cable Company, has been elected a director of the Erie Telegraph & Telephone Company.

New Companies Incorporated.

The Independent Telephone Company, Waco, Tex.—to construct telephone lines and maintain exchanges throughout the State of Texas. Capital stock, $75,000. Incorporators: Sam Sanger, Ed. N. Stephenson, J. B. Earle, J. E. Boynton, W. M. Seley and E. Rotan.

The Audubon & Kimballton Telephone Company, Audubon, Ia.—to establish a telephone line connecting Audubon and Kimballton with Elkhorn, Poplar and Sharon Cemetery. Capital stock, $900. Incorporators: Pede Lykke and others.

The Vinton Telephone Company, Vinton, Cal. Authorized capital, $20,000. Incorporators: A. B. Bentley, L. H. Dunning, E. Ramelli, J. Bates, F. Campbell, all of Vinton.

The North Arkansas Telephone Company, Fayetteville, Ark. Capital stock, $25,000. Incorporators: Millard Berry, James W. Dupree, J. P. Dearer and Walter E. Berry.

The Florence & Allison Telephone Company, Florence, S. C. Capital stock, $1,000. President, R. O. Commander; secretary and treasurer, O. Poston.

The Cambridge Telephone Company, Cambridge, Ill. Capital stock, $600. Incorporators: J. A. Kirkland, G. A. Vawter and James Pollock.

The Henry County Telephone Company, London, Ia. Capital stock, $1,000. Incorporators: E. C. Stevenson and others.

The People's Telephone Company, Dillon, S. C. Incorporators: C. A. Woods, E. L. Moore and John Wilcox.

ELECTRICAL SECURITIES.

The subjoined quotations of Electrical Securities dealt in at the leading commercial centers are compiled from special reports received by ELECTRICITY from a variety of sources. The utmost care is exercised in their collection and preparation, and every effort is made to secure accurate and reliable information. The management of this journal will esteem it a favor to have brought to their attention any inaccuracies readers may discover in these columns.

Abbreviations: crt. indb., certificate of indebtedness; coll., collateral; cons., consolidated; const., construction; conv., convertible; com., common; deb., debentures; exten., extension; gen., general; g., gold; guar., guaranteed; inc., income; imp., improvement; pd., paid; pfd., preferred; mtg., mortgage; tr., trust; A., annually; S., semi-annually; Q., quarterly; A. & O., Apl. and Oct.; F. & A., Feb. and Aug.; M. & S., May and Sept.; J. & D., July and Dec.; J. & J., Jan. and June.

STOCKS.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Albany, N. Y.—Jan 3:						
Albany Ry. Co	100	2,000,000	$1,750,000	1½ % Q., Aug. '98.	150½	151
Troy City Railway Co	100	2,000,000	2,000,000	1 % Q., Aug., 98.	65	67
Traction Co. (Saratoga)	100	50,000	50,000	....	.	..
Allentown Pa.—Jan 3:						
Allentown & Lehigh Val. Trac. Co.		4,000,000	1,500,000	....	..	15
Bridgeport, Conn—Jan 3:						
Bridgeport Traction Co	100	2,000,000	2,000,000	1 % Aug., '97.	50	..
Baltimore, Md.—Jan 3:						
Baltimore City Passenger Ry. Co	25	6,000,000	2,500,000	5 % S., July 2, '98.	...	...
aBaltimore Consolidated Ry. Co	25	10,000,000	9,177,000	2 % S., July 15, '98	81⅜	82
Central Ry. Co. of Baltimore City	50	800,000	800,000	6 % A. Dec., 1897.	...	..
Boston, Mass.—Jan 3:						
New England Street Ry	25	5,000,000	1,081,925	1 % Q., Jan.15, '97.	18¼	18¾
North Shore Traction Co.......com.	100	4,000,000	4,000,000	....	12	15
North Shore Traction Co.......pfd.	100	2,000,000	2,000,000	6 % S., A. & O.	82¼	...
b West End Street Ry. Co.......com	50	10,000,000	9,085,000	3½ % S., Oct., '98.	89¾	91
West End Street Ry. Co...8 % pfd.	50	6,400,000	6,400,000	4 % S., Oct. 1, '98.	110	110½
Boston Elevated R. R	100	10,000,000		2¼ % Aug. 98,	80½	81½
Brooklyn N. Y.—Jan 3:						
Brooklyn City & Newtown Ry	100	2,000,000	1,928,400	2 % Feb. 1, 1898.	250	..
Brooklyn Rap. Transit Co., tr certf.	100	20,000,000	20,000,000	....	79¾	..
cBrooklyn Heights Railroad	....	200,000	200,000	....	..	..
*dBrooklyn City RR.........guar	100	12,000,000	12,000,000	2½ % Q., July, 98.	212½	243
eBrooklyn, Queens Co. & Sub. RR.	....	2,000,000	2,000,000	....	..	..
Coney Island & Brooklyn RR	100	1,000,000	1,000,000	1½ % Oct. 1, '97.	252	230
Kings County Elevated	....	4,750,000	4,750,000	....	4½	5½
Kings County Traction Co	100	4,500,000	4,500,000	1 % July 26, '97	48	..
Nassau Electric Railroad.......pfd.	......	6,000,000	6,000,000	....	70	..
fAtlantic Avenue Railroad	50	2,000,000	2,000,000	....	..	..
gBrooklyn, B & W. E. Railroad	....	1,000,000	1,000,000	....	..	..
Buffalo. N. Y.—Jan 3.						
Buffalo & Niagara Falls Elec. Ry	100	1,250,000	1,250,000	....	60	66
*Buffalo Railway Co	100	6,000,000	5,870,500	1 % Q. Dec., '97.	76½	78½
Columbus O.—Jan 3.						
Columbus Street Railroad	100	8,000,000	8,000,000	1 % Q., Aug., '98.	60	65
Columbus Central Street Railroad	100	1,500,000	1,500,000	....	..	..
Charleston, S. C.—Jan 3:						
Charleston City Ry. Co	50	100,000	100,000	8 % S., Jan., '98.	..	..
Enterprise City RR. Co	25	1,000,000	250,000	....	..	..
Chicago, Ill.—Jan 3:						
Chicago City Ry. Co	100	12,000,000	12,000,000	8 % Q.	295	300
Chicago & South Side R. T. RR	100	10,323,800	10,323,800	....	..	..
Lake Street Elevated RR	100	10,000,000	10,000,000	....	18½	...
Metropolitan West Side Elev. Ry	100	15,000,000	15,000,000	....	..	4
Met. West Side El. const. stk	100	15,000,000	2,500,000	....	..	..
North Chicago Street RR	100	10,000,000	6,600,000	8 % Q., Oct., 98.	224	225
hNorth Chicago City RR	100	500,000	249,900	....	..	..
South Chicago City Railway	100	2,000,000	1,603,200	....	..	..
iWest Chicago St. RR. Co	100	20,000,000	18,189,000	1½ % Q., Nov. 98	98	...
jChicago West Div. Ry.......guar.	....	1,250,000	624,900	35 %	..	..
kChicago Passenger Ry.......guar.	100	2,000,000	2,000,000	5 % S.	..	..
Cincinnati, Ohio.—Jan 3						
Cincinnati Inc. Plane Ry.......com.	50	1,000,000	575,000	....	..	..
Cincinnati Inc. Plane Ry........pfd.	50	150,000	150,000	2½ %., Feb., '98.	..	..
Cincinnati, Newport & Cov. St. Ry.	100	4,000,000	3,500,000	....	...	80¼
lCincinnati Street Ry. Co	50	18,000,000	14,000,000	1¼ % Q., Jan., '98.	118¾	119¼
Mt. Adams & Eden Park Inc. Ry.	50	2,500,000	2,200,000	1¼ % Q., Jan., 98.	..	..
Cleveland, Ohio.—Jan 3:						
Akron, Bed. & Clev. Elec. Ry	100	1,000,000	1,000,000	¾ % Jan., '98	40	42
Cleveland City Ry	100	8,000,000	7,600,000	¾ %., Oct., '98.	62½	68½
Cleveland Electric Ry	100	12,000,000	12,000,000	¾ % Q., Oct., '98	82	82½
Detroit, Mich.—Jan 3:						
Detroit Citizens' Street Ry	100	2,000,000	1,250,000	....	100½	..
Ft. Wayne & Belle Isle Ry	100	400,000	400,000	5 % July, '96.	175	..
Rapid Railway Co	....	250,000	250,000	....	90	100
Detroit Electric Railway	...	1,000,000	1,000,000	....	...	..
Wyandotte & Detroit River Ry	100	250,000	200,000	....	100	110
Dayton O.—Jan 3:						
City Railway Co..............com.	100	1,500,000	1,470,600	1¼ % Q., Jan.1,'98.	108½	109
City Railway Co...............pfd.	100	600,000	600,000	1½ % Q., Jan. 1,'98	155	157
People's Street Railway	....	1,100,000	....	....	105	..

*Unlisted. †Ex div.

a Consolidation of Baltimore Traction Company and City & Suburban Railway Company. Company controls Citizens' Railway, North Baltimore Passenger Railway, Baltimore & Curtis Bay Street Railway, Baltimore & Powhatan Railway, Pimlico & Pikesville Railway and Wallbrook, Gwynn Oak & Powhatan Railway and Park.

b Leased to Boston Elevated Railroad Company.

c Owned by Brooklyn Rapid Transit Company.

d Leased to Brooklyn Heights Railroad. Co., which guarantees 10 % on capital stock.

e Stock owned by Brooklyn Rapid Transit Company; road operated by Brooklyn Hts. Co.

f Stock owned by Kings County Traction Company; road leased to Nassau Electric RR

g Owned by Atlantic Ave. RR. and leased to Nassau system.

h $30 per share on outstanding capital paid as rental by lessee—West Chicago St. RR. Co.: $250,100 of stock owned by North Chicago Street Railroad Company.

i Controls by lease Chicago West Division Railway, Chicago Passenger Railway, and West Chicago Street Railroad Tunnel Company.

j 35 % per annum paid on outstanding capital as rental by lessee—North Chicago Street Railroad Company; $625,100 of stock owned by West Chicago Street Railroad Company.

k Majority of stock owned by Chicago West Division Railway Company; 5 % on $1,000,000 stock guaranteed by West Chicago Street Railway Company, lessee.

l Cincinnati St. Ry. Co. purchased the Mt. A. & Eden Park road assuming its bonds.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Capital Stock. Issued.	Rate and Date of Last Div.	Bid.	Asked.
Hartford Conn.—Jan 3:						
Hartford Street Ry. Co	100	$4,000,000	‖200,000	8 % S., Jan., '98.	140	—
Hartford & West Hartford RR	100	1,000,000	247,000	....	..	—
Holyoke Mass.—Jan 3:						
Holyoke Street Ry. Co	100	400,000	400,000	8 % A., Jan., '98.	185	200
Hoboken, N. J.—Jan 3:						
North Hudson Co. (N. J.) Ry. Co	25	1,250,000	1,000,000	8 %, 1892.	105	—
Indianapolis, Ind—Jan 3						
**Citizens' Passenger Ry	...	5,000,000	5,000,000	....	80	..
Lancaster, Pa.—Jan 3:						
Pennsylvania Traction Co	100	10,000,000	9,900,000	....	..	—
Lancaster & Col. Electric Ry	....	....	87,500	....	..	—
West End Street Railway	...	....	....	....	..	—
Louisville, Ky.—Jan 3:						
Louisville Ry...................com.	100	4,000,000	8,500,000	1¼ %., Oct., '97.	35	40
Louisville Ry..................pfd	100	2,500,000	2,500,000	2½ % S., Oct. 1, '98.	101	103
Minneapolis, Minn.—Jan 3:						
Twin City Rapid Transit........com.	100	17,000,000	15,010,000	....	28	31
Twin City Rapid Transit....7 % pfd.	....	8,000,000	1,714,200	1¾ %. Jan., '98.	101	103
Montreal, Canada.—Jan 3						
Montreal Street Ry. Co	50	4,000,000	4,000,000	8 % S., M. & N.	..	..
Toronto Street Ry. Co	100	6,000,000	6,000,000	1¾ % S., J. & J.	108¼	108⅝
Memphis, Tenn.—Jan 3:						
Memphis Street Railway Co	100	500,000	500,000	....	15	—
New Haven, Conn.—Jan 3:						
Fair Haven & Westville RR	25	1,500,000	900,000	8 % S., Sept. '98.	80	...
New Haven Street Railway Co	100	1,250,000	1,000,000	2½ % A., July '96.	60	80
New Haven & Centerville	100	700,000	800,000	....	..	—
Winchester Avenue RR	25	1,000,000	600,000	....	45	..
New Orleans, La.—Jan 3:						
Canal & Claiborne RR. Co	40	240,000	240,000	4 % S., Jan., '98.	152	200
New Orleans & Carrollton RR	100	1,200,000	1,200,000	1½ % Q., Jan., 98.	122	127
New Orleans Traction Co.......com.	100	5,000,000	5,000,000	....	2	2½
New Orleans Traction Co.......pfd.	100	2,500,000	2,500,000	....	8¼	11
aCrescent City RR.............guar.	100	2,000,000	2,000,000	3 % S., Jan., '98.	18	21
bNew Or. City & Lake RR....guar.	100	2,000,000	2,000,000	4 % S., Jan., '98.	..	..
Orleans Railroad	50	500,000	185,000	1½ %., June, '94.	25	27
St. Charles Street Railway	50	1,000,000	1,000,000	1½ %. Jan., '98.	54	58
New York—Jan 3						
Central Crosstown RR	100	600,000	600,000	2½ % Q	255	260
cChristopher & 10th Sts. RR..guar.	100	650,000	650,000	2 % Q., July, '98.	170	..
Dry Dock, E. Brdw'y & Battery RR.	100	1,200,000	1,200,000	1½ % Q., Aug., 98.	18[illegible]	190
dMetropolitan Street Ry. Co	100	30,000,000	30,000,000	1¼ % Q., Oct., 98	191¾	192
eBleecker St. & Fulton Fy. Ry. guar	100	900,000	900,000	¾ % A., July, '98.	8[illegible]	84
fBroadway & Seventh Ave...guar.	100	2,100,000	2,100,000	2½ % Q.	250	..
gCen. Park, N. & E. Rivers RR. guar	100	1,800,000	1,800,000	2¼ % Q.	177½	183
hEighth Avenue RR	100	1,000,000	1,000,000	....	375	400
i42d St. & Grand St. Ferry RR. guar	100	750,000	748,000	4½ % Q.	385	400
jNinth Avenue RR.........guar.	100	800,000	800,000	....	180	190
kSixth Avenue RR..........guar	100	2,000,000	2,000,000	....	200	210
lTwenty-third St. R. R. Co..guar.	100	600,000	600,000	4½ % Q.	390	410
Second Avenue RR	100	2,500,000	1,862,000	2 % Q., July, '98.	190	195
Third Avenue RR	100	12,000,000	10,000,000	$2 p. sh. Aug. '98.	165	168
m42d St., Manhatv'le & St. Nich. Av	100	2,500,000	2,500,000	....	75	77
*Union (Huckleberry) Ry.	100	2,000,000	2,000,000	....	175	200
Newark N. J.—Jan 3						
Consolidated Traction Co. of N. J	100	15,000,000	15,000,000	....	57	58
Newark Passenger Ry	100	6,000,000	6,000,000	....	..	..
nRapid Transit Street Ry	100	504,000	504,000	11¾ % A.	195	205
Pittsburg, Pa.—Jan 3:						
Allegheny Traction Co	50	500,000	500,000	....	..	..
oConsolidated Traction Co....com.	50	15,000,000	15,000,000	2 %, Jan., '95.	22	22⅛
Consolidated Traction Co......pfd.	50	15,000,000	15,000,000	3 %. May, '97.	59⅞	60
pCentral Traction Co	50	1,500,000	‖900,000	1½ % Nov 7, '98.	.	...
qCitizens' Traction Co	50	8,000,000	‡3,000,000	6 % A.	64	65
rDuquesne Traction Co	50	8,000,000	‡3,000,000	6 % A.	..	...
sPittsburg Traction Co	50	2,500,000	1,900,000	3½ %, Nov. 7, '98.	..	..
Federal St. & Pleasant Valley Ry	25	1,400,000	1,400,000	2½ %, Jan., '98.	26⅛	..
Pgh., Allegheny & Man. Trac. Co	50	8,000,000	‖2,994,839	2 %, Aug., '95.	..	..
Pittsburg & Birmingham Trac. Ry	25	8,000,000	8,000,000	½ %, Jan., '96.	24½	...
Pittsburg & West End Ry.	50	1,500,000	1,500,000	5 % A., June 30, 98.	..	..
Second Avenue Traction Co...com	50	4,000,000	‡4,000,000	....	..	..
Suburban Rapid Transit Co	50	300,000	200,000	....	..	..

*Unlisted. ‡Full paid. ‖Outstanding. †Ex div.

a Leased to New Orleans Traction Company at 6 % on stock.

b Leased to New Orleans Traction Company at 8 % on stock.

c Leased to Central Crosstown Railroad at 8 % on stock and interest on bonds.

d Operating the former Met. Trac. system, that corporation having become extinct.

e Leased to 23d Street Ry. for 99 years; lease assigned to Metropolitan Street Ry.

f Leased to Houston, West Street & Pavonia Ferry—now Metropolitan Street Railway.

g Leased to Metropolitan Street Railway at 8 % on stock until Oct. 1, 1897; thereafter 9 %

h Leased to Metropolitan Street Ry. for 99 years from Jan. 1, 1896, at $[illegible]5,000 per annum.

i Leased to Metropolitan Street Railway for 18 % on stock.

j Leased to Met. St. Ry. for 99 years from April 20, 1892; 6 % first 5 years, 8 % thereafter

k Leased to Metropolitan Street Railway for $145,000 per annum.

l Leased to Metropolitan Street Railway for 18 per cent. on capital stock.

m Controlled by Third Avenue Railroad by purchase.

n Dividends of 1¾ % yearly guaranteed by Consolidated Traction Company.

o Controls by lease the Alleg'ny, Cent., Citizens, Duquesne, Fort Pitt and Pitts'h Trac. Co

p Leased to Consolidated Traction Company for 8 % per annum on par value of stock

q Leased to Fort Pitt Traction Company for 6 % on $3,000,000 capital stock.

r Leased to Consolidated Traction Company for 4 % on capital stock.

s Leased to Consolidated Traction Company for 7 % on capital stock.

PASSENGER RAILWAYS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
New Bedford Mass—Jan 3						
Union Street Railway Co	100	$350,000	$850,000	2 %, Feb. 98.	...	150
Northampton, Mass—Jan 3						
Northampton Street Rv	100	800,000	225,000	4 % A., Jan., '98.	165	175
Omaha, Neb.—Jan 3.						
Omaha Street Rv	100	5,000,000	5,000,000	....	25	30
Paterson, N. J.—Jan 3:						
Paterson Ry. Co	100	1,250,000	1,250,000	....	54	..
Providence, R. I.—Jan 3:						
United Traction & Electric Co	100	8,000,000	8,000,000	¼ %, Jan. '98.	80¼	..
Philadelphia.—Jan 3:						
Fairmount Park Trans. Co...$20 pd.	50	2,000,000	1,770,000	2 %, Dec. '97.	14⅛	..
Hestonville, Man. & Fairmount	50	1,968,100	†1,966,100	2½ %, July 15, '98.	42	..
Hest'nvl'e, Man. & Fairm't..6 % pfd.	50	533,900	†533,900	3 % S—July, '98.	68	..
*a*Fairmount Pk. & Had. Pass. Ry.	50	300,000	300,000	3 % Feb. 1, '98.	66	..
Union Traction Co........ $12½ pd	50	30,000,000	29,930,450	....	32⅛	82¼
*b*Electric Traction Co	50	....	8,297,920	....	...	...
*d*Citizens' Passenger Ry	50	500,000	†192,500	$3 share Q.	330	..
*e*Frankford & Southwark Pas. R	50	....	†1,875,000	$14 sha'e A—Apr.98	405	..
*f*Lehigh Avenue Ry. Co	50	1,000,000	....	....	48	..
*f*Lombard & South Street Ry	25	....	1,000,000	A. & O.	90	90½
*d*Second & Third Streets Ry	50	1,060,000	†771,076	$9 share A, Mar. 98	275	..
*c*People's Traction Co	50	10,000,000	†6,000,000	3 %, A., April, '98.	..	..
*g*Germantown Passenger Ry	50	1,500,000	†572,800	$5.25 share—1898.	135	138¼
*g*Green & Coates Passenger Ry.	50	500,000	†150,000	3 % Jan., 1898.	135⅛	..
*h*People's Passenger Ry....com.	25	1,500,000	†740,000	....	...	...
*h*People's Passenger Ry....pfd.	..	750,000	†277,102	....	...	...
*i*Philadelphia Traction Co	50	30,000,000	20,000,000	$2 p. sh., Oct. 98.	94½	95
*j*Catherine & Bainbridge St	50	....	†100,000	6 % A—Mar., '98.	...	...
*j*Continental Pass. Ry......guar.	50	1,000,000	†580,000	$6 share—July, '98.	140	145
Empire Passenger Ry. Co	50	600,000	†600,000	....	...	...
*j*Philadelphia City Pass. Ry	50	1,000,000	†475,000	$7.50 share July '98	170	180
*j*Philadelphia & Gray's Fy. RR.	50	1,000,000	298,650	$3.50 share July '98	90	..
*j*Ridge Avenue Passenger Ry	50	750,000	†420,000	$12 share, July '98.	295	300
*j*Philadelphia & Darby Ry.guar.	50	....	†200,000	$2 share July, '98.	...	..
*j*17th & 19th Sts. Pass. Ry. guar.	50	....	†250,000	1½ % S., July, '98.	157½	..
*j*Thirteenth & 15th Sts. Pass. Ry.	50	1,000,000	†335,000	$11 sh. A., July, '98	210	..
*j*Union Passenger Ry. Co	50	1,500,000	†900,000	$9.50 shre, July '98	228	..
*j*West Philadelphia Pass. Ry	50	750,000	†750,000	$10 share, July '98	235	250
Rochester, N. Y.—Jan 3:						
Rochester Railway Co	100	5,000,000	5,000,000	....	14	16
Reading, Pa.—Jan 3:						
*j*Reading Traction Co	..	1,000,000	1,000,000	Semi-an., Jan. & Jy	18	20
*k*City Passenger Ry	50	350,000	350,000	Jan., '98.	114	..
*l*East Reading Electric Ry	50	1,000,000	†1,000,000	Jan., '98.	65	..
St. Louis Mo.—Jan 3:						
Fourth Street & Arsenal Ry	50	800,000	150,000	....	..	..
Jefferson Avenue Ry. Co	50	400,000	400,000	2 % Dec., 1888.	..	..
Lindell Ry	100	2,500,000	2,400,000	1¼ % Oct., '98.	167	169
National Railway Co	..	2,500,000	2,479,000	1½ %, Oct., '98.	..	..
Cass Avenue & Fair Grounds	..	2,500,000	2,500,000	....	..	..
Citizens' RR	100	2,000,000	1,500,000	1 %, Oct., '93.	..	..
St. Louis RR	100	2,000,000	2,000,000	2½ %, July, '98.	115	120
Missouri RR	50	2,400,000	2,300,000	1½ % Oct., '98.	190	193
People's RR. Co	50	1,000,000	300,000	50c., Dec., '89.	..	..
Southern Electric Ry.........com.	50	500,000	500,000	....	62	64
Southern Electric Ry......6 % pref.	100	1,000,000	1,000,000	3 %, July, '98.	130	131
St. Louis & Suburban Ry	100	2,500,000	2,500,000	....	56½	57¼
Union Depot RR	100	4,000,000	4,000,000	3 % A., July, '95.	125	150
San Francisco, Cal.—Dec.						
California St. Cable RR	100	1,000,000	600,000	50c. monthly.	109	..
Geary Street Park & Ocean RR	100	1,000,000	375,000	$2.50 share, '96.	45	50
Market Street Ry	100	18,750,000	18,750,000	Q., 60c. per share.	55½	56
Presidio & Ferries RR	100	1,000,000	550,000		8½	..
Scranton, Pa—Jan 3						
Scranton Railway Co	50	6,000,000	2,500,000	....	12½	15
*m*Scranton & Carbondale Trac. Co.	100	500,000	500,000	....	14	18
*m*Scranton & Pittston Traction Co.	100	1,050,000	1,050,000	....	..	..
Springfield Ill.—Jan 3:						
Springfield Consolidated Ry	100	750,000	750,000	....	—	..
Springfield O.—Jan 3:						
Springfield Street Ry	100	1,000,000	1,000,000	....	..	..
Springfield, Mass.—Jan 3:						
Springfield Street Ry	100	1,200,000	1,166,700	8 % A.	200	207½
Toronto Canada.—Jan 3:						
Toronto Ry. Co	100	6,000,000	6,000,000	1¾ % S.	108¼	108⅜
Montreal Street Railway Co	.....	4,000,000	4,000,000	4 % S.		
Washington, D. C.—Jan 3:						
Belt Ry. Co	50	500,000	500,000			
Capital Traction Co	100	†12,000,000	12,000,000	65c. per sh. Oct. 97.	87¼	88
Columbia Ry. Co	50	400,000	400,000	6 % A.	65	75
Eckington & Soldiers' Home Ry	50	707,000	652,000		20	25
Georgetown & Tenallytown Ry	50	200,000	200,000		..	..
Metropolitan RR. Co	50	1,000,000	453,900	2½ % Q.	143½	146
Worcester, Mass.—Jan 3:						
*Worcester Traction Co.........com.	100	3,000,000	3,000,000		14	16
*Worcester Traction Co.....6 % pfd.	100	2,000,000	2,000,000	3 % S., Feb., '98.	96	98
Worcester & Suburban Street Ry	100	550,000	542,500	4½ %, 1897.	85	...
Wilkesbarre, Pa.—Jan 3:						
Wilkesbarre & Wyoming Val. Trac.	100	5,000,000	5,000,000	1 % Jan., '97	24	29

* Unlisted. † Paid in. ‡ Full paid. ‖ Outstanding. § Ex div.
a Leased to Hestonville, Man. & Fairmount Passenger Ry. for 6 % on stock per annum
b Consolidation of Electric, People's and Philadelphia Traction companies. Fixed charges and all indebtedness of constituent and leased companies assumed by Union Traction Company.
c Practically all shares owned by Union Traction Company.
d Lease to Frankford & Southwark Passenger Ry. assumed by Electric Traction Co.
e Leased to Electric Traction Company.
Controlled by Frankford & Southwark Passenger Railway
g Leased to People's Passenger Railway at $5 per share.
h Majority of stock owned by People's Traction Company.
i Leased to Union Traction Company.
j Lease transferred to Union Traction Company.
jj Leased to United Traction Co. at a rental of $10,000 per an. in 1866-7-8, $20,000 p. a., in 1899-1900 and $30,000 per annum thereafter, payable semi-annually, rental declared as a dividend semi-annually.
k Dividend of 10 % guaranteed by Reading Traction Company.
l Dividend of 6 % guaranteed by Reading Traction Company.
m Leased and operated by the Scranton Railway Company, formerly Scranton Trac. Co.

TELEPHONE AND TELEGRAPH COS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Jan 3:						
American Bell Telephone Co	100	50,000,000	23,650,000	4½ % Q., Oct., '98.	273	274
Erie Telegraph & Telephone Co	100	......	......	1 % Q., Aug '98.	75	77
New England Telephone Co	..	10,394,600	10,804,600	$1.50 %, Aug. '98.	135	..
New York.—Jan 3:						
American Telegraph & Cable Co	100	14,000,000	14,000,000	1¼ % Q	98½	100
*Central & South Am. Teleg. Co	100	6,500,000	6,500,000	1½ % Q.	108	110
*Commercial Cable Co	100	10,000,000	10,000,000	1¾ % Q.	185	190
Franklin Teleg. Co......2½ % guar.	100	1,000,000	......	1¼ % S.	40	50
Erie Telegraph & Telephone Co	100	5,000,000	4,800,000	1 % Q., Aug., '98.	75	77
*Gold & Stock Telg. Co..guar. 6 %	100	5,000,000	......	1½ % Q.	112	118
*International Ocean Tel Co.guar6%	100	3,000,000	......	1½ % Q.	108	..
Mexican Telephone Co	100	2,000,000	......	....	..	80
*New York & New Jersey Tel. Co	100	5,000,000	3,723,000	1¼ % Q., Oct., '98.	158	159
*Pacific & Atlantic Teleg..guar. 4 %	25	2,000,000	......	2 % S.	75	80
*Postal Telegraph Cable Co	100	15,000,000	15,000,000	1 % Q.	..	..
*Sout'n & Atlantic Telg. Co.guar.5 %	25	950,000	559,525	2½ % S.	90	93
†Commercial Union Telegraph Co	25	500,000	500,000	3 % S., July, '98.	112	118
Western Union Telegraph Co	..	......	97,370,000	1¼ %, Oct., '98.	94½	95
†Div. guar. by Postal Teleg. Co.						
Miscellaneous.—Jan 3:						
American Dist. Teleg. (Phila.)	25	400,000	......	1 % Q., Aug., '98.	14	..
Bell Teleph. Co. (of Canada.)	100	8,168,000	8,168,000	2 % S.	171	..
Chesapeake & Potomac Telep. Co	100	......	......	....	53	58
Chicago Telephone Co	100	......	......	....	2.0	..
Central Dist Prtg & Telg. Co. (Pgh.)	100	750,000	750,000	....	132½	134
Empire & Bay States Telegraph Co.	...	......	......	....	75	77
Hudson River Telephone Co	100	2,000,000	2,000,000	1 % Q.	83	..
*Northwestern Telegraph Co..guar	50	2,500,000	2,500,000	2½ % Q.	112	118
Providence (R. I.) Teleph. Co	50	....	......	....	90	..
Southern New Eng. Teleph. Co	100	8,000,000	......	....	121	135

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston, Mass.—Jan 3:						
Fort Wayne Electric Co	..	......	......	....	..	..
Ft. Wayne Elec Co. T. Sec. Series A.	25	......	......	....	...	..
†General Electric Co. [old] ... com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new] ...... "	100	18,276,000	18,276,000	......	95⅛	..
T.-H. Elec. Co..T. Secur., Series D.	..	......	......	....	2¼	8¼
Westinghouse Elec. & Mfg. Co. com.	50	......	146,700	....	39⅛	40⅞
Westinghouse El. & Mfg. Co. pfd.	50	4,000,000	3,996,053	1¾ % Q., Oct., '98.	62	62⅞
Westinghouse El. & Mfg. Co. assent.	50	11,000,000	8,195,126	......	..	..
New York.—Jan 3:						
Edison Elec. Ill'g Co., New York	100	9,138,000	7,988,000	....	191	193
*Edison Elec. Ill'g Co., Brooklyn	100	4,000,000	2,000,000	1½ % Oct., '98.	..	..
Edison Ore Milling Co	100	......	......	....	11	14
Edison Electric Storage Co	..	......	......	....	23	30
†General Electric Co. [old].... com.	100	40,000,000	30,460,000	2 % Q., Aug., 1898.	..	..
General Electric Co. [new].... "	100	18,276,000	18,276,000	......	95⅛	96
Interior Conduit & Insulation Co	100	1,000,000	1,000,000	....	41	..
Pittsburg, Pa.—Jan 3:						
Allegheny County Light Co	100	500,000	500,000	J. & J.	165	175
East End Electric Light Co	50	800,000	800,000	Q	..	..
Philadelphia, Pa.—Jan 3:						
Edison Electric Light Co	100	2,000,000	......	......	144⅛	..
*Electric Storage Battery Co..com.	100	8,500,000	......	......	59	59⅛
*Electric Storage Battery Co...pfd.	100	5,000,000	......	......	66	67
‡ Kings Co. El L. & P. Co	100	2,500,000	2,500,000	A. & O.	..	151
*Penna. Ht., Lt. & Pow. Co.....com.	50	5,000,000	......	6 %, Oct., '97.	..	..
Northern Elec. Light & Power Co	10	550,000	550,000	$32500 dis. Jan. 11'97	13¾	14
Southern Elec. Light & Power Co	10	187,500	187,500	....	13¼	..
Miscellaneous.—Jan 3:						
Brush Electric Co	50	......	......	......		
Bridgeport (Conn.) Elec. Lt. Co	25	500,000	......	......	41	45
Missouri-Edison (St. Louis)....com.	..	......	......	......	24⅛	28⅛
Eddy Electric Mfg. Co	25	......	......	......	—	15
Hartford (Conn.) Elec. Light Co	100	850,000	......	......	125	..
Hartford (Conn.) Lt. & Power Co	25	175,000	......	......	4½	..
New Haven (Conn.) Elec. Lt. Co	100	100,000	......	......	177	..
Narragansett (Prov., R.I.) Elec. Co.	50	1,200,000	......	2 % Q., Oct., '98.	84	..
Rhode Island Elec. Protec. Co	100	......	......	......	118½	125
Royal Elec. Co. (Montreal)	..	1,000,000	......	2½ Q	‡162½	163⅛
Toronto (Canada) Elec. Light Co	100	1,085,000	1,085,000	1¾ % Q	137¾	138
Thomson-Houston Welding Co	100	......	......	3 % S, Dec. 1, '96.	..	100
Woonsocket (R. I.) Electric Co	100	......	......	....	100	..

†On Aug. 17 last by a majority vote of the stockholders the capital stock was reduced to $20,827,100. of which $18,276,000 is common and $2,551,200 preferred. ‡ Ex div.

ALLIED INDUSTRIES.

NAME.	Par	Capital Stock. Authorz'd	Issued.	Rate and Date of Last Div.	Bid.	Asked.
Boston Mass.—Jan 3:						
American Electric Heating Co	50	10,000,000	....	....	..	..
Street Ry. & Illu'g Properties...pfd	100	4,500,000	1,248,700	$2 p. sh. Nov. 16, '98	..	85
United Electric Securities Co...pfd.	100	......	1,000,000	3½ % May 2, '98.	92	100
New York.—Jan 3:						
Consolidated Electric Storage Co	...	......	....	...	9⅛	16
Edison European	...	......	....	...	..	..
Safety Car Heating & Lighting Co	100	......	....	...	103	110
Worthington Pump Co.........com.	100	5,500,000	5,500,000	......	37	42
Worthington Pump Co.........pfd	100	2,000,000	2,000,000	7 %	101	102
Philadelphia, Pa.—Jan 3:						
Acetylene L. H. & P. Co......$35 pd.	50	1,000,000	......	....	..	..
Electro Pneumatic Trans. Co	10	1,500,000	......	....	..	..
United Gas Improvement Co..scrip.	50	10,000,000	......	....	..	..
Welsbach Commercial Co......com.	100	8,500,000	......	....	10	15
Welsbach Commercial Co......pfd.	100	500,000	......	2 % Q	62	65
Welsbach Light Co	5	525,100	......	....	39⅞	40
Welsbach Light Co., Canada	5	500,000	......	....	..	2¼
Pittsburg, Pa.—Jan 3:						
Carborundum Mfg. Co	100	200,000	200,000	...		
Standard Underground Cable Co	100	1,000,000	1,000,000	Q	125	127
Miscellaneous.—Jan 3:						
*Barney & Smith Car Co........com.	100	......	1,000,000	....	14	16
*Barney & Smith Car Co........pfd.	100	......	2,500,000	2 %	68	71
Billings & Spencer Co	25	......	....	....	..	..
Consol. Car Heating Co	100	1,250,000	1,250,000	1½ % Feb. '98.	37	45
Johns-Pratt Co	100	......	....	....	90	100
Pratt & Whitney Co.........com.	100	......	....	....	4½	..
Pratt & Whitney Co.........pfd	100	......	....	....	35	40
Stillwell-Bierce Co........com.	..	......	....	....	..	..
Stillwell-Bierce Co........pfd.	..	......	....	2 % Sept. 1, '98.	95	98
Shultz Belting Co	100	500,000	....	....	82	87
St. Charles Car Co	—	......	....	...	85	90

* Unlisted.

BONDS.

PASSENGER RAILWAY.

Albany, N. Y.

Date of Quotation—Jan 3, 1899

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
The Albany Ry...............1st mtg. 6s.	....	$29,000	1905	....	....	....
The Albany Ry. Co......Cons. mtg. 5s.	$500,000	427,500	1930	J. & J.	*115½	......
‡The Albany Ry. Co......Gen. mtg. 5s.	750,000	875,000	1947	M. & N.	*114	115
‖Watervliet Turnpike & RR. 1st mtg. 6s	850,000	850,000	1919	M. & N.	*120	....
‖Watervliet Turnpike & RR..2d mtg. 6s.	150,000	150,000	1919	M. & N.	*116	....
Troy City Railway Co...................1st 5s	....	....	......	......	*106½	......

‡Interest guar. by Albany Ry. Co.
‖Principal and interest guar. by Albany Ry. Co.

Baltimore Md.

Date of Quotation—Jan 3, 1899

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Baltimore City Pass. Ry...1st mtg. g. 5s.	2,000,000	2,000,000	1911	M. & N.	113	114
Baltimore Traction Co.......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	116	116⅛
Baltimore Trac. Co..Exten. & Imp. g. 6s.	1,250,000	1,250,000	1901	M. & S.	103	104
Bal. Trac. Co..No. Balto div. 1st mtg. g. 5s	1,750,000	1,750,000	1942	J. & D.	117	118
†Bal. Trac. Co. Coll. Trust, 1st mtg. g. 5s.	750,000	....	1900	J. & J.	......	......
†Baltimore Traction Co. Convertible 5s.	800,000	....	1906	N. & M.	103½	......
Central Pass. Ry. Co..........1st mtg. 6s	96,000	117,000	1912	J. & J.	.....	....
‡Central Pass. Ry. Co..Cons. mtg. g. 5s	601,000	580,000	1932	M. & N.	115	116
City & Suburban Ry......1st mtg. g 5-	3,000,000	3,000,000	1922	J. & D.	116	.....
Lake Roland Elev., ...1st mtg. 5s.	1,000,000	1,000,000	1942	M. & S.	113	113½
Metropolitan Ry. (Wash.). 1st mtg. g. 5s.	1,850,000	1,850,000	1925	F. & A	120¾	......

†The bonds of the Baltimore Traction Co., the City & Suburban Ry. and the Lake Roland Elev. were all assumed by the Baltimore Consolidated Ry. Co.
‡$151,000 in escrow to retire 1st. mtg. bds.

Boston, Mass.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Lynn & Boston RR.......1st mtg. g. 5s.	5,879,000	3,702,000	1924	J. & D.	107¼	108½
West End Street Ry.........Deben. g. 5s.	3,000,000	3,000,000	1902	M. & N.	105	105¼
West End Street Ry.......Deben. g. 4½s.	2,000,000	2,000,000	1914	M. & S.	108	....

†$1,674,000 in escrow to retire outstanding bonds of absorbed companies.

Charleston S. C.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Enterprise Street RR.........1st mtg. 5s.	500,000	47,000	1906	J. & J.	...	..
†Charleston City Ry..........1st mtg. 6s.	850,000	....	....	J. & J.	....	....

†Controlled by Charleston St. Ry. Co.

Chicago Ill.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Chicago City Ry............1st mtg. 4½s.	6,000,000	4,619,500	1901	J. & J.	102¾	103
‡Chicago Passenger Ry......1st mtg. 6s.	400,000	400,000	1903	F. & A.	....	102
‡Chicago Passenger Ry...Cons. mtg. 6s.	1,000,000	600,000	1929	J. & D.	......	....
¶Chicago & So. Side R. T...1st mtg. g. 5s.	7,500,000	7,500,000	1929	A. & O.	....	....
Chicago & So. Side R. T. ....4½s.	1,500,000	750,000	1907	J. & J.	....	......
‖Chicago West Div. Ry.....1st mtg 4½s.	4,040,000	4,040,000	1932	J. & J.	105½	......
Lake Street Elevated RR..1st mtg. g. 5s.	7,574,000	3,781,200	1928	J. & J.	....	......
Metrop. W. Side Elev. Ry..1st mtg. g. 5s.	15,000,000	15,000,000	1942	F. & A.	61½	......
North Chicago St. RR.........1st mtg. 5s.	3,171,000	3,171,000	1906	J. & J.	104¾	.....
North Chicago St. RR....Cert. indeb. 6s.	500,000	500,000	1911	J. & J.	.. ..	......
North Chicago City Ry......1st mtg. 6s.	500,000	500,000	1900	J. & J.	101½	....
North Chicago City Ry.....consol. 4½s.	2,500,000	2,500,000	1927	M. & N.	106½	107
West Chicago St. RR.........1st mtg. 5s.	4,100,000	3,969,000	1928	M. & N.	103½	......
West Chicago St. RR.........Deben. 6s...	2,700,000	700,000	1911	J. & D.	100½	......
West Chicago St. RR....Con. mtg. g. 5s.	12,500,000	6,000,000	1936	......	96	96¼
§W. Chicago St. RR. Tunnel..1st mtg. 5s.	1,500,000	1,500,000	1909	F. & A.	......	....

†Redeemable at option on 60 da. notice.
‡Funded debt assumed by Chicago W. Div. Ry. Co., controlling interest of which is owned by W. Chicago St. RR. Co., lessee.
¶Subject to call after Oct. 1, 1899, at $110 and interest.
‖Assumed by W. Chi. RR. Co., lessee.
§Int. guar. by W. Chicago St. RR. Co.

Cincinnati, O.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Cin. New. & Cov. St. Ry. 1st Con. mtg. g. 5s	8,000,000	2,500,000	1922	J. & J.	106	106¼
'Mt. Adams & Eden P'k In...1st mtg. 6s.	46,000	46,000	1900	A. & O.	103½	104
†Mt. Adams & Eden P'k In...1st mtg. 6s.	100,000	100,000	1905	A. & O.	111	112¾
†Mt. Adams & Eden P'k Inc. Cons. mtg. 5s	531,000	531,000	1906	M. & S.	108	.....
So. Cov. & Cin. St. Ry.........1st mtg. 6s.	250,000	250,000	1912	M. & S.	119¾	.....
‖So. Cov. & Cin. St. Ry.........2d mtg. 6s.	400,000	400,000	1932	J. & J.	131	184

† Assumed by the Cincin. St. Ry. Co.
‖$250,000 reserved to retire 1st mtg. bds.

Cleveland, O.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
aBrooklyn Street RR. Co......1st mtg. 6s.	600,000	600,000	1908	M. & S.	105¼	106
Cin. New't & Cov. St. Ry..Cons. mtg. 5s.	8,000,000	2,500,000	1922	J. & J.	106	106¼
Cleveland City Cable Ry......1st mtg. 5s.	2,000,000	2,000,000	1909	J. & J.	105¼	106
†Cleveland Electric Ry. Co. 1st mtg. 5s.	3,500,000	1,249,000	1913	M. & S.	105¼	106
Columbus (O.) Cent. Ry...1st mtg. g. 5s.	1,500,000	1,500,000	1918	M. & N.	......	......
aEast Cleveland RR...........1st mtg. 5s.	1,000,000	1,000,000	1910	M. & S.	107	108
Ft. Wayne (Ind.) Elec. Ry. 1st mtg. g. 6s.	600,000	....	1922	M. & N.	......	....
Lorain (O.) Street Ry.........1st mtg. 6s.	200,000	200,000	1915	J. & J.	......	....
‡St. Ry. Co., Grand Rapids...1st mtg. 5s	600,000	600,000	1912	J. & D.	....	....

†$1,900,000 in escrow to retire bonds of absorbed companies, marked a.
‡Interest guar. by Cons. St. Ry. Co.

Detroit, Mich.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Detroit Citizens' St. Ry.....1st mtg. 5s.	7,000,000	8,885,000	1905	A. & O.	98½	100
Ft. Wayne & Belle Isle Ry...1st mtg. 6s	400,000	877,000	1902	A. & O.	....	....
The Detroit Ry.................1st mtg. 5s.	1,800,000	1,800,000	1925	J.&D.	100	105

†$1,150,000 in escrow to retire bonds of Det. City Ry. and Grand River St. Ry.

New Haven Conn.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
New Haven St. Ry..........1st mtg. g. 5s.	600,000	600,000	1918	M. & S.	108	......
New Haven (Edgewood Div.) 1st mtg. 5s	250,000	250,000	1914	J. & D.	107	......
Winchester Avenue RR...1st mtg. g. 5s.	500,000	500,000	1912	M. & N.	106	....
Winchester Avenue RR....Deben. g. 5	100,000	[illegible]	1909	M. & S	101	....

New Orleans La.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Canal & Claiborne RR.........1st mtg. 6s.	$150,000	$150,000	1912	M. & N.	108	......
Crescent City RR............1st mtg. 6s.	......	50,000	1899	M. & N.	101	......
Crescent City RR.......Cons. mtg. g. 5s.	5,000,000	3,000,000	1943	J. & J.	83⅞	84¼
New Orleans City RR.........1st mtg. 6s.	416,500	399,000	1903	J. & D.	.....	104½
†N. Orl's City & Lake RR..1st mtg. g. 5s.	5,000,000	2,599,500	1943	J. & J.	107¼	108¼
N. Orleans & Carrollton RR. 2d mtg. g. 6s.	850,000	350,000	1907	F. & A.	111	....
Orleans Railroad Co.......Cons. mtg. 6s.	800,000	800,000	1912	J. & J.	89	....
‡St. Charles St. RR. Co......1st. mtg. 6s.	800,000	75,000	1906	J. & D.	106	......

†$423,500 in escrow to retire New Orleans City RR. Co.'s 1st mtg. bonds.
‡$90,000 outstanding.

New York.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Atlantic Ave. (Brooklyn)....Imp. g. 5s.	1,500,000	1,500,000	1934	J. & J.	95	....
Atlantic Av. (Brooklyn). 1st gen. mtg. 5s.	759,000	759,000	1909	M. & S.	107	......
†Atlantic Av. (Brooklyn)..Cons. mtg. 5s.	3,000,000	1,966,000	1931	A. & O.	110	111
‡Bro'dway & 7th Ave. 1st cons. mtg. g. 5s.	12,500,000	7,650,000	1943	J. & D.	122½	123½
Broadway & 7th Ave.........1st mtg. 5s.	1,500,000	1,500,000	1904	J. & D.	105	106
Broadway & 7th Ave.........2d mtg. 5s.	500,000	500,000	1914	J. & J.	111	112
Broadway Surface...........1st mtg. 5s.	1,125,000	1,125,000	1924	......	116	119
Broadway Surface............2d mtg. 5s.	1,000,000	1,000,000	1905	......	105	107
Brooklyn City RR. Co..1st cons. mtg. 5s.	6,000,000	6,000,000	1941	J. & J.	116¼	117¼
Brooklyn City & Newtown..1st mtg. 5s.	2,000,000	2,000,000	1939	J. & J.	114	118
¶Brooklyn, Bath & W.E. RR. Gen. mtg. 5s.	1,000,000	448,000	1933	J. & J.	90	......
Brooklyn Heights RR......1st. mtg. 5s.	250,000	250,000	1941	A. & O.	104	106
Brooklyn, Q's Co. & Sub'n..1st mtg 5s.	3,500,000	3,500,000	1941	J. & J.	110½	112
Brooklyn, Q's Co. & Sub'n..1st cons. 5s.	4,500,000	2,750,000	1941	M. & N.	103	105
Brooklyn Rapid Transit.........gold 5s.	7,000,000	5,181,000	1945	....	107	......
Bleecker St. & Fult'n Fer'y RR. 1st mtg. 7s	700,000	700,000	1900	......	103½	105
Cent P'k, N. & E. R. RR. 1st cons. mtg. 7s.	1,200,000	1,200,000	1902	J. & D.	111½	113
Central Crosstown RR........1st mtg. 6s.	250,000	250,000	1922	M. & N.	118	120
Coney Island & Brooklyn RR. 1st mtg. 5s	300,000	300,000	1903	J. & J.	102	104
§D. Dock, E. Bd'y & Bat'y R. gen. mtg. g. 5s	1,000,000	930,000	1932	J. & D.	115	118
Dry Dock, E. Bd'y & Bat'y RR..scrip 5 %.	1,100,000	1,100,000	1914	F. & A.	101	104½
Eighth Av. RR. Co.....Cert. indebt. 6 %.	1,000,000	1,000,000	1914	F. & A.	108	....
42d St., Man. & St. Nich. Av..1st mtg. 6s.	1,200,000	1,200,000	1910	M. & S.	115½	117½
42d St., Man. & St. N. Av..2d mtg. inc. 6s.	1,500,000	1,500,000	1915	J. & J.	97½	99
Lex. Ave. & Pav. Ferry RR. 1st mtg. g. 5s.	5,000,000	5,000,000	1993	M. & S.	121½	125
Metropolitan St Ry Co..g. m. cl. tr. g. 5s	12,500,000	1 ,500,000	1997	F. & A.	118¾	....
Second Avenue Ry..Gen. cons. mtg. 5s.	1,600,000	1,600,000	1909	M. & N.	117	118
Second Avenue Ry..............Deb. 5s.	300,000	300,000	1909	J. & J.		. ...
Steinway Ry. (L. I.).......1st mtg. g. 6s.	1,500,000	1,500,000	1922	J. & J.	114	115½
South Ferry RR. Co..........1st mtg. 5s.	850,000	850,000	1919	......	110	114
Third Avenue RR..........1st mtg. g. 5s.	5,000,000	5,000,000	1937	J. & J.	128	......
Twenty-third Street Ry......1st mtg. 6s.	....	....	1909	J. & J.	......	.
Twenty-third Street Ry..........Deb. 5s	150,000	150,000	1906	J. & J.	103	106
Union (Huckleberry) Ry.....1st mtg. 5s.	2,000,000	2,000,000	1942	F. & A	115	117
‡‡Westchester Electric RR...1st mtg. 5s.	500,000	500,000	1943	J. & J.	111	112½

†$1,085,000 in escrow to retire gen. mtg. bonds.
‡$4,850,000 in escrow to retire maturing obligations.
¶$552,000 in escrow to retire 1st and 2d mtg. bonds.
§In treasury, $80,000.
‡‡ Guar. by Union Ry. Co.

Toronto Canada.

Date of Quotation—Jan 3 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Montreal St. Ry......................1st mtg. 5s.	2,500,000	800,000	1908	M. & S.	....	....
†Toronto St. Ry............1st mtg. g. 4½s.	4,550,000	2,200,000	1921	M. & S.	....	....

†$35,000 per m. single track authorized. $600,000 in escrow to retire 6s due in 1901.

Philadelphia.

Date of Quotation Jan 3, 1899

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Continental Pass. Ry...........1st. mtg. 6s	850,000	810,000	1909	J. & J.	....	....
Empire Pass. Ry.....................1st mtg. 7s	800,000	200,000	1900	J. & J.	....	....
Greene & Coates St. Ry..........1st mtg. 6s	100,000	100,000	1898	J. & J.	....	....
Lombard & So. St. Pass. Ry...1st mtg. 6s	150,000	....	1901	....	....	....
People's Pass. Ry...................1st mtg. 7s	250,000	250,000	1905	J. & J.	....	....
People's Pass. Ry...................2d mtg. 5s	500,000	458,000	1911	J. & J.	....	....
People's Pass. Ry.............Cons. mtg. 5s	1,125,000	867,000	1912	M. & S.	....	....
People's Pass. Ry.......Stk. trs. cert. g. 4s	5,698,210	....	1943	....	105½	105¾
Phila. City Passenger Ry......1st mtg. 5s	200,000	200,000	1910	J & J.	......	....
Philadelphia Trac. Co........Coll. tr. g. 4s	1,300,000	1,018,000	1917	F. & A	104	105
Thirteenth & 15th St. Ry........1st mtg. 7s.	100,000	100,000	1903	A. & O	....	....
Union Passenger Ry..............1st mtg. 5s.	500,000	500,000	1911	A. & O.	....	....
§Union Traction Co...............Col tr. 4s.	29,735,000	29,724,876	1945	A. & O.	....	......
West End Passenger Ry.........1st mtg. 7s.	....	....	1905	....	....	....
West Phila. Pass. Ry.........1st mtg. g. 6s.	250,000	246,000	1906	A. & O.	115¼	....
West. Phila. Pass. Ry............2d mtg. 5s.	750,000	750,000	1926	M. & N.	116	116½

§ The trust certificates were issued to pay for the shares of the Electric and People's Traction lines purchased.

Pittsburg, Pa.

Date of Quotation—Jan 3 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Birmingham, Knox & Allentown......6s.	500,000	500,060	1931	M. & S.	95	......
Central Traction Co...............1st mtg. 5s.	875,000	375,000	1930	J. & J	107⅞	....
Citizens' Traction Co.............1st mtg. 5s.	1,250,000	1,250,000	1927	A. & O.	116½	......
*Duquesne Traction Co.........1st mtg. 5s.	1,500,000	1,500,000	1930	J. & J.	114	....
*Fed'l St. & Pleas. Val. Jack's Run.....5s.	50,000	50,000	1913	J. & J.	......	......
Fed'l St. & Pleasant Valley........Cons. 5s.	1,250,000	1,250,000	1942	J. & J.	......	....
Millvale, Etna & Sharpsburg..............5s.	750,000	750,000	1923	M. & N.	108½	......
Pittsburg, Crafton & Mansfield...........5s.	250,000	250,000	1924	J. & J.	......	....
Pittsburg Traction Co............1st mtg. 5s.	750,000	750,000	1927	A. & O.	.....	....
Pittsburg & Birmingham......1st mtg. 5s.	1,500,000	1,500,000	1929	M. & N.	107½	....
Pittsburg & West End.........1st mtg. 5s.	500,000	500,000	1922	J. & J.		......
*Pg'h., Allegh. & Manch.....Gen. mtg. 5s.	1,500,000	1,400,000	1930	A. & O.	115	......
Second Ave. Traction Co...................5s.	2,500,000	2,000,000	1934	J. & D.	......	....
Sub. Rapid Transit Railway Co..........6s.	500,000	500,000	1918	M. & S.	......	....

Providence R. I.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
Newport Street Ry..................Coupon 5s	50,000	50,000	1910	J. & D.		
United Trac. & Elec. Co.....1st mtg. g. 5s	9,000,000	8,260,000	1933	M. & S.	108½	110

St. Louis.

Date of Quotation—Jan 3, 1899.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
†Baden & St. Louis RR.........1st mtg. 5s.	250,000	250,000	1918	J. & J.	101	103
Cass Ave. & Fair Gds. Ry......1st mtg. 5s.	2,000,000	1,901,000	1912	J. & J.	102	104
Citizens' Railway Co............1st mtg. 6s.	2,000,000	1,500,000	1907	J. & J.	107	108
†Comp. Hts., Un. De. & Mer. Ter.–1st 6s	[illegible]	[illegible]	1918	J. & J.	1'8	115

* With interest. ' Unlisted.

PASSENGER RAILWAY.

NAME.	Amount. Authorized.	Amount. Issued.	Due	Interest periods.	Bid.	Asked.
St. Louis. *Date of Quotation—Jan 3, 1899*						
Jefferson Avenue Ry..........1st mtg. 5s.	400,000	400,000	1905	M. & N.	101	103
Lindell Ry. Co..........1st mtg. 5s	1,500,000	1,500,000	1911	F. & A.	108½	110½
Missouri RR. Co..........	1,000,000	700,000	1916	M. & S.	107	108
‡Mound City RR. Co..........1st mtg. 6s.	400,000	300,000	1910	A. & O.	101	103
People's RR. Co..........1st mtg. 6s.	125,000	125,000	1902	J. & D.	98	101
‖People's RR. Co..........2d mtg. 7s.	75,000	75,000	1902	M. & N.	97½	100
People's RR. Co..........Cons. mtg. 6s.	1,000,000	800,000	1904	J. & J.	....	....
St. Louis & E. St. L. Electric..1st mtg. 6s.	75,000	75,000	1905	J. & J.	100	101
St. Louis RR. Co..........1st mtg. 5s.	2,000,000	2,000,000	1900	M. & N.	101	101½
§St. Louis & Sub. Ry..........1st mtg. g. 5s.	2,000,000	1,400,000	1921	F. & A.	105	107
St. Louis & Sub. Ry..........Income 5s.	300,000	300,000	......	....	65	70
††Southern Electric Ry....Cons. mtg. 6s.	500,000	500,000	1909	M. & N.	113	115
‡Taylor Avenue St. Ry..........1st mtg. g. 6s.	500,000	500,000	1918	J. & J.	113½	115
Union Depot RR. Co....1st cons. mtg. 6s.	1,091,000	1,091,000	1900	A. & O.	102½	103½
Union Depot RR. Co..........Cons. mtg. 6s.	3,500,000	1,787,000	1918	J. & J.	116½	117½
†Controlled by St. Louis RR. Co.						
‡Controlled by Union Depot RR. Co.						
‡Controlled by Lindell RR. Co.						
‖$200,000 in escrow to retire 1st & 2d mtg.						
§$600,000 in escrow.						
††$200,000 in escrow to retire 1st mtg. bonds.						
San Francisco Cal. *Date of Quotation—Dec, 1898.*						
California St. Cable RR.....1st mtg. g. 5s.	1,000,000	900,000	1915	J. & J.	115½	117
†Ferries & Cliff House Ry.....1st mtg. 6s.	650,000	650,000	1914	M. & S.	114½	......
Geary St., Park & Ocean RR..1st. mtg. 5s.	1,000,000	671,000	1921	A. & O.	....	100
Market St. Cable Ry. Co....1st mtg. g. 6s.	3,000,000	3,000,000	1913	J. & J.	128½	129
†Metropolitan Ry. Co..........1st mtg.	200,000	....	......	....	....	......
†Omnibus Cable Co..........1st mtg. 6s.	2,000,000	2,000,000	1918	A. & O.	126	......
†Park & Cliff House RR..........1st mtg. 6s.	350,000	350,000	1912	J. & J.	106½	108½
†Park & Ocean RR..........1st mtg. 6s.	250,000	250,000	1914	J. & J.	112	......
†Powell St. Ry..........1st mtg. 6s.	700,000	700,000	1912	M. & S.	......	123
Sutter St. Ry. Co..........1st mtg. g. 5s.	1,000,000	900,000	1918	M. & N.	....	......
†Controlled by Market St. Ry. Co.						
Washington D. C. *Date of Quotation—Jan 3, 1899.*						
Belt Ry. Co. ....O... mtg 5s.	500,000	450,000	1920	J. & J.	51	....
Columbia Ry.......... mtg. 6s.	500,000	500,000	1914	A. & O.	118	125
Eckington & Soldiers' Home mtg. 6s.	200,000	200,000	1911	J. & D.	100	105
Metropolitan RR. Co.....Coll tr. cons. 6s.	500,000	500,000	1901	J. & J.	128	......
†$50,000 in escrow to retire 1st mtg.bds.						
Miscellaneous. *Date of Quotation—Jan 3, 1899.*						
Bridgeport Traction Co........1st mtg. 5s.	2,000,000	1,683,000	1923	J. & J.	103	......
Buffalo (N. Y.) Ry. Co........Cons. mtg. 5s.	5,000,000	3,543,000	1931	F. & A.	112¼	114
†Citizens' St. R. (Ind'polis).1st cons.m.5s	4,000,000	3,000,000	1933	M. & N.	83¾	......
‡Crosstown St. Ry. (Buffalo)..1st. mtg.5s.	3,000,000	2,366,000	1932	M. & N.	111½	112¼
¶Columbus (O.) St. Ry......1st cons. g. 5s.	3,000,000	2,261,000	1932	J. & J.	103	105
Consolidated Traction (N. J.)..1st mtg.5s	15,000,000	13,965,000	1933	J. & D.	108¼	109¼
‖Crosst'n St. Ry. (Colu's, O.)..1st mtg.g.5s	2,000,000	572,000	1933	J. & D.	102	102½
Denver City Cable Ry........1st mtg. g. 6s.	4,000,000	3,800,000	1920	J. & J.	18	22
Denver Con. Tram'y Co.....Con. m. g. 5s.	4,000,000	922,000	1933	A. & O.	80	83
Louisville (Ky.) Ry...1st cons. mtg. g.5s.	6,000,000	4,931,000	1930	J. & J.	116	117
§Minneapolis St. Ry..1st cons. mtg. g. 5s	5,000,000	4,050,000	1919	J. & J.	100	102
††No. Hudson Co.Ry.(N.J.).Cons.mtg. 5s	3,000,000	2,378,000	1928	J. & J.	101	......
No. Hudson Co. Ry. (N.J.)..2d mtg. 5s.	550,000	550,000	1928	M. & N.	....	......
No. Hudson Co. Ry. (N. J.)......Deb. 6s.	500,000	439,000	1902	F. & A.	....	......
Paterson (N. J.) Ry......Cons. mtg g. 6s.	1,250,000	1,000,000	1931	J. & D.	108	108½
Rochester (N. Y.) Ry..........1st mtg. 5s.	3,000,000	2,000,000	1930	A. & O.	105	......
St. Paul City Ry..........Cons. g. 6s.	5,500,000	4,298,000	1937	......	......	......
St. Paul City Ry..........Deb. g. 6s.	1,000,000	1,000,000	1900	......	......	......
†$1,000,000 in escrow to retire 1st and 2d mtg. bds.						
‡$800,000 in treasury. Bonds guar. by Buffalo Ry. Co.						
¶$760,000 in escrow to retire bonds of O. C. St. RR. Co.						
‖$87,000 in treasury.						
§$960,000 res'ved to redeem prior liens.						
††$620,000 in escrow.						
					*With int'rest	

ELECTRIC LIGHT AND ELECTRICAL MFG. COS.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Boston, Mass. *Date of Quotation—Jan 3, 1899*						
Edison Elec. Illuminating Co., Boston....	2,026,000	....	......	Quar.	156	....
General Electric Co..gold coup, deb. 5s..	10,000,000	8,750,000	1922	....	108	....
Pittsburg Pa *Date of Quotation—Jan 3, 1899*						
Allegheny County Light Co..........6s.	500,000	......	1911	J. & J.	106	......
Allegheny City Electric Light..........4s.	260,000	......	1918	A. & O.	......	......
Westinghouse Elec. & Mfg. Co..Scrip 6s.	195,570	......	......	M. & S.	......	......
Miscellaneous.—(Jan 3, 1899.)						
Edison El. Illg. Co. (N. York) 1st m. 5s..	4,312,000	4,312,000	1910	......	111½	112
Edison El. Illg. Co. (N. Y.) con. m. g. 5s.	15,000,000	2,188,000	1993	......	123	......
Edison Elec. Illg. Co. (Brooklyn)........	2,500,000	1,500,000	1940	......	110	115
Edison Electric Light (Philadelphia)..	2,000,000	......	......	......	......	......
Edison Illg. Co. (St. Louis)........	4,000,000	......	1923	F. & A.	......	......
Mo. Elec. Lt. Co. (St. Louis)...1st mtg. 6s.	500,000	....	1909	A. & O.	......	......
Mo. Elec. Lt. Co. (St. Louis)...2d mtg. 6s.	600,000	....	1921	Q'ry.	......	......
United Elec. Light & Power Co(N. Y.)..	5,000,000	......	...	......	......	......

TELEPHONE AND TELEGRAPH.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation—Jan 3, 1899*						
American Bell Telephone..........7s.	....	....	1898	F. & A.	102	....
Northwestern Telegraph Co..........7s.	......	......	....	......	......	....
N.Y. & N.J. Telep & Telg Co. gen.mtg.5s	......	......	....	......	106	....
Chesapeake & Potomac Teleph. Co...5s.	....	....	1911	J. & D.	108	....

ALLIED INDUSTRIES.

NAME.	Authorized.	Issued.	Due	Interest periods.	Bid.	Asked.
Miscellaneous. *Date of Quotation—Jan 3, 1899.*						
American Electric Heating..........5s.	500,000	500,000	....	....	.15	.19
Armington & Sims Eng. Co..........	....	....	....	....	....	25
Barney & Smith Car Co..........†6s	....	....	1942	J. & J.	97	100
Carborundum Mfg. Co..........6s.	....	....	1904	M. & S.	....	....
Worthington Pump Co	75,000	....	....	....	....	....

*Unlisted †Nominal

NOTES FOR INVESTORS.

Late quotations for copper are: Electrolytic, 12.65@12.75c.; Lake, 12.75@13c.; casting, 12.65@12.75c.

The Southern Electric Railroad of St. Louis declared a semi-annual dividend of 3 per cent., payable on the 2d inst.

The North Chicago Street Railway Company has declared a dividend of 3 per cent., payable on and after January 15.

The Mexican Telegraph Company has declared a quarterly dividend of 2½ per cent., payable January 13. Books reopen January 14.

The Sprague Electric Company of Watsessing, N. J., with a capital of $5,000,000, has been licensed to do business in Illinois with a capital of $2,000.

The Central & South American Telegraph Company has declared a quarterly dividend of 1½ per cent., payable January 6. Books reopen January 7.

Application has been received at the New York Stock Exchange to list $2,000,000 Edison Electric Illuminating Company of Brooklyn first consolidated mortgage coupon bonds of 1939.

The electric railroad known as the Los Angeles & Pasadena Railroad Company, operating between Los Angeles and Altadena, Cal., has passed into the possession of the Southern Pacific Company, the purchase price being $1,000,000.

The Columbia Street Railway, Washington, D. C., has placed a mortgage for $500,000 on its line in favor of the American Security & Trust Company, to secure 500 bonds of $1,000 each, for the purpose of extending its lines on Bennings road.

The American Bell Telephone Company has sold $3,000,000 of its 4 per cent. 10-year debenture bonds to Lee, Higginson & Co., R. L. Day & Co., and Estabrook & Co. The total issue is $10,000,000, and the present sale makes $8,000,000 outstanding.

The stockholders of the National Electric Car Lighting Company will meet at the office, 30 Broad street, New York, on January 5 to vote on the proposition to issue $500,000 preferred stock. The present capital is $2,000,000, all common, and all in shares of $50 each.

Thirteen thousand shares of Brooklyn City Railroad stock were sold at auction on Wednesday last at the New York Real Estate Salesroom by Andrew H. Muller & Son, auctioneers. The stock brought from 242¼ to 242½. It was bought by H. A Eaton, who, it was reported, acted for the Mutual Life Insurance Company.

The United Electric Securities Company, Boston, will receive proposals until January 6 for the sale of as many of its collateral trust 5 per cent. bonds as can be purchased with the following amounts of cash: Third series, $36,021; fourth series, $26,091; sixth series, $1,470; seventh series, $1,943; total, $65,526.

The Safety Car Heating & Lighting Company has declared a regular a semi-annual dividend of 3 per cent., and an extra dividend of 2 per cent. This will make 8 per cent. payments for the year. It is understood that it is the intention of the management to put the company's stock on a regular annual basis of 8 per cent.

An electric light company has been incorporated at Harrisburg, Pa., to take over all the companies controlled by the Pennsylvania Manufacturing, Light & Power Company of Philadelphia. The proposed capital is $25,000,000 stock and $10,000,000 bonds. It is proposed to call an installment of 10 per cent. when the shares are issued. The securities are to be listed on the Philadelphia Stock Exchange.

Secretary of State Hay has officially announced his disapproval of the contract entered into between the Hawaiian Government (subject to the approval of the United States) and the Pacific Cable Company of New York. The action of the Secretary is in accordance with the terms of the contract, which provides that it shall not take effect if disapproved by the State Department within six months from July 2, 1898.

The reported "absorption" by the North Jersey Railway Company of the North Hudson Street Railway Company of Hudson County, N. J., is thus explained by Bernard M. Shanley of Newark, who is manager of the North Jersey Company and a large stockholder of the company: "For upward of five years I have owned, with others, a quarter interest in the North Hudson Company, and now we have purchased from J. O H. Pitney enough of the stock of the company to secure us the controlling power; but the company will be run as the North Hudson Company and will be entirely independent of the North Jersey Company."

The Cleveland (O.) Electric Railway (Big Consolidated) directors have again declared a quarterly dividend of 1 per cent., payable January 5. This was generally expected, though many thought the increase in the last dividend was to boom the stock, as the earnings were not supposed to be large enough to keep it up. The gross earnings for 1898 are only slightly ahead of 1897, but the net earnings show a marked increase over that year. The annual meeting for the election of officers is expected to take place on January 18. The stockholders of the Little Consolidated will have their annual meeting to elect officers January 9.

The Baltimore "News" of the 29th ult. says: "The opinion prevails in financial circles that the deal involving the consolidation of the railway systems is off for the present, though negotiations may be resumed at any time. There have been no conferences between Mr. Nelson Perin, representing the Consolidated, and Mr. Alexander Brown, representing the syndicate, since the announcement of the hitch in the deal. This was one week ago last Saturday. Neither Mr. Perin nor Mr. Brown will admit that negotiations have been broken off, though there is no doubt that the hitch is serious, but whether serious enough to defeat the amalgamation of the properties is a question that time will decide."

The Buffalo General Electric Company has, says the "Financial Chronicle," called for redemption at 104 and interest its entire issue of 6 per cent. bonds of 1892, and will pay them off on February 1, 1899. The authorized amount of this loan is $2,400,000, but only $1,575,000 have been issued. In addition there is outstanding a small loan of the old Thomson-Houston Company, one of the companies absorbed, which is due February 1, 1900, making the Buffalo Company's total funded debt about $2,000,000, all represented by 6 per cent. bonds. These will be refunded into new forty-year 5 per cent. gold bonds, effecting a substantial decrease in the fixed charges. More than 95 per cent. of the holders of the old 6s of 1892, it is stated, have agreed to exchange their present holdings for the new bonds. The Fidelity Trust & Guaranty Company of Buffalo has the matter in charge.

The capitalization of the companies merged by the big gas deal which has been announced from Philadelphia is: Consolidated Gas Company, $6,500,000 in shares and $5,000,000 in 5 per cent. bonds; the preferred stock is $4,000,000, guaranteed 6 per cent., and the common, $2,500,000; the Philadelphia Company, $7,500,000; the Allegheny County Electric Light Company, $1,500,000; the Allegheny Heating Company, $500,000; the Chartiers Valley Gas Company, $4,000,000, and the Pennsylvania Natural Gas Company, $1,000,000—a total of $26,000,000. Mr. Westinghouse, as reported in the Pittsburg "Leader," states "that Messrs. Brown Bros. & Co. of New York have exercised their option to purchase the stock of the Philadelphia Company at $40 per share and the stock of the Allegheny County Electric Light Company at $180 per share, and that contracts have been duly signed whereby all of the details will be concluded on or before March 1, 1899. Notices will be forthwith mailed to all stockholders of both companies, who will be required to deposit their shares on or before January 15 in exchange for negotiable receipts."

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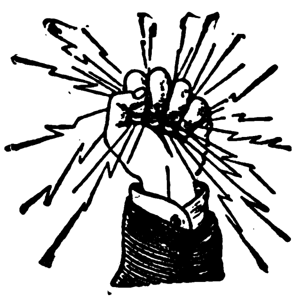

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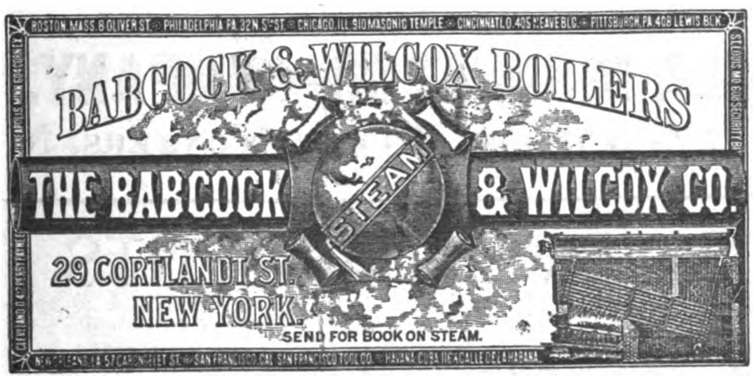

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Part I.

Allsop, F. B. Electrical Bell Construction, Treatise on the Construction of Electric Bells, Indicators, and similar apparatus. 177 Illustrations, 12mo, cloth. London, 1890 .... 1 25

Ayrton, W. E. Practical Electricity; a Laboratory and Lecture Course for First-year of Students of Electrical Engineering, based on the Practical Definitions of the Electrical Units. With numerous Illustrations. 12mo, cl. London, 1889 .... 2 50

Badt, F. B. The Dynamo Tenders Hand-Book, with 70 illustrations, 16mo, cloth, Chicago, 1888 .... 1 00

—— **and Carhart, Prof. H. S.** Derivation of Practical Electrical Units. 12mo, cloth. Chicago, 1890 75

Bell, Dr. Louis. The Elements of Practical Electricity. In press......

Benjamin, Park. The Age of Electricity. From Amber-soul to Telephone. 12mo, cl. New York, 1888 .... 2 00

Bennet, A. R. The Telephoning of Great Cities and an Electrical Parcel Exchange System. Two Papers read before the British Association at Cardiff. Revised edition. Numerous diagrams. London, 1892 40

Blakesley, T. H. Papers on Alternating Currents of Electricity for the Use of Students and Engineers. Second edition, enlarged. 12mo, cloth. London, 1889 .... 1 50

Bonney, G. E. Electro-Plater's Hand Book. A Manual for Amateurs and young Students on Electro-Metallurgy. 60 illustrations. 12mo, cloth. London, 1891 .... 1 20

Bottone, S. R. Electrical Instrument Making for Amateurs. A Practical Handbook, with 48 illustrations. Fourth edition. Enlarged by a chapter on The Telephone. 12m, clo. London, 1890. Reduced to 50

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Crocker, F. B. and S. S. Wheeler. The Practical Management of Dynamos and Motors. Illustrated, cl. N. Y., 1892. In press ....

Crosby, O. T. and Dr. Louis Bell. The Electric Railway in Theory and Practice. A complete Treatise on the Construction and Operation of Electric Railways. Illustrated, cloth. New York, 1892 .... 2 50

Cumming, L. Electricity treated Experimentally. For the use of Schools and Students. New edition. 12mo, cloth. London, 1890 .... 1 50

Desmond, Charles. Electricity for Engineers. 12mo 2 50

De La Rive, A. Treatise on Electricity, in Theory and Practice. Translated by C. V. Walker, 3 vols. 8 vo, cloth, London, 1853 .... 25 00

Dolbear, Prof. A. E. The Telephone. An Account of the Phenomena of Electricity, Magnetism and Sound, as Involved in its Action, with directions for making a Speaking Telephone. 16mo, cl. illustrated. Boston, 1888 50

Electricity in Daily Life. A popular Account of the Science and Application of Electricity to Every-day Uses. With 120 Illustrations. 8vo, cloth. N. Y., 1890 .... 3 00

Emtage, W. T. A. An Introduction to the Mathematical Theory of Electricity and Magnetism. 12mo, cloth. Oxford, 1891. 1 90

Ewing, Prof. A. J. The Magnetic Induction in Iron and other Metals. 159 Illustrations. 8vo, cloth. London, 1891 .... 4 00

Faraday, M. Experimental Researches in Electricity. 3 vols. 8vo, cl. London, 1839-55 .... 25 00

Fiske, Lt. Bradley, A., U. S. N. Electricity in Theory and Practice, or The Elements of Electrical Engineering. 8th ed. 8vo, cl. 180 illustrations. N. Y., 1891 .... 2 50

Fleming, J. A. Short Lectures to Electrical Artisans. A course of Experimental Lectures delivered to a Practical Audience. 3d Ed. 74 illustrations. 12mo, cl. 1890 .... 1 50

Forbes, Prof. Geo. A Course of Lectures on Electricity. Delivered before the Society of Arts. 82 illustrations. 12mo, cl. London. 1887 .... 1 50

Gladstone, J. H., and Alfred Tribe. The Chemistry of the Secondary Batteries of Planté and Faure. 12mo, cl., illustrated. London, 1883 .... 1 00

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Gardon, Mrs. J. E. H. and J. E. H. Decorative Electricity. With a chapter on Fire Risks. (New and cheaper edition). London, 2 40

Gore, G. The Art of Electro-Metallurgy, including all Known Processes of Electro-Deposition. Fourth edition. 12mo, cl., ill. 2 00

Gore, G. Theory and Practice of Electro Deposition, including every known mode of depositing Metals—Preparing Metal and for Immersion—Inking Moulds and rendering them Conducting. 12mo, cl. London, 1887 80

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Haskins, C. H. The Galvanometer and its Uses. A Manual for Electricians and Students. 4th edition, revised. 12mo, mor., ill. 1 50

Hedges, K. Central Station Lighting. Notes on Methods used for the Distribution of Electricity. Illustrated. 12mo, cl. London, 1889 .... 1 25

Herring, Carl. Principles of Dynamo Electro Machines; Practical Directions for Designing and Constructing Dynamos. With an Appendix containing several Articles on allied subjects, and a table of equivalents of Units of Measurement. With 59 illustrations. 12mo, cl. N. Y. 1888 .... 2 50

—— Table of Equivalents of Units of Measurements. 12mo, paper. New York, 1888 50

Hopkinson, Dr. John. Dynamic Electricity: Its Modern Use and Measurement, chiefly in its Application to Electric Lighting and Telegraphy; including I., some Points in Electric Lighting. II. On the Measurement of Electricity for Commercial Purposes. By J. N. Shoolbred. III. Electric Light Arithmetic. By R. E. Day. 16mo, boards 50

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Jamieson, A. Elementary Manual of Magnetism and Electricity. Specially arranged for the use of First Year Science and Art Department and other Electrical Students. With numerous illustrated experiments and examination questions. 2nd edition. 12mo, cloth. London, 1891 .... 1 25

Jenkin, Fleming. Electricity and Magnetism, with an Appendix on the Telephone and Microphone. 9th edition. 12mo, cl. London, 1886 .... 1 25

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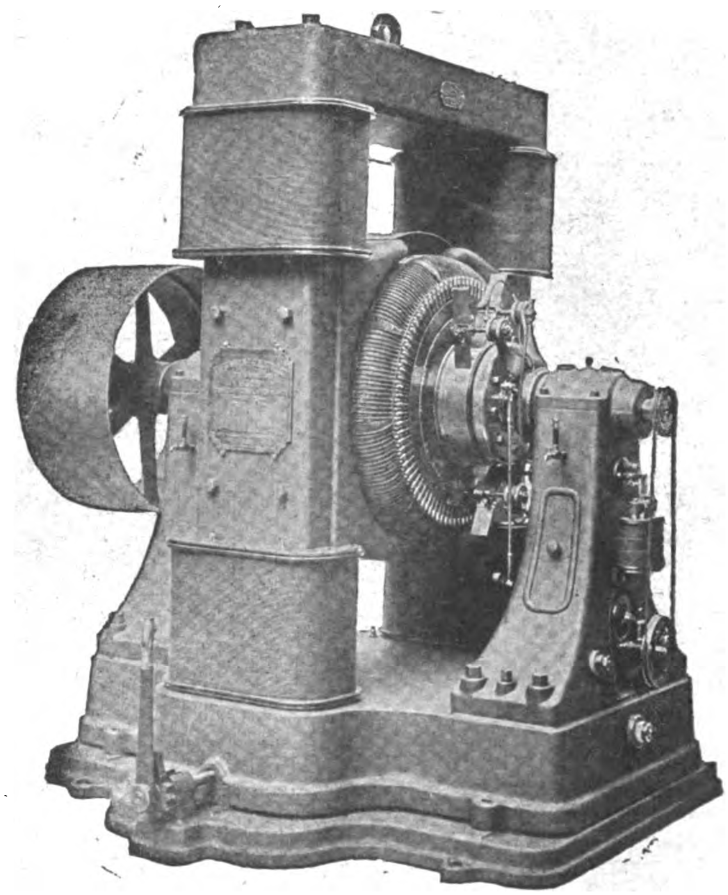

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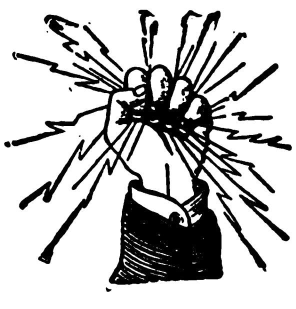

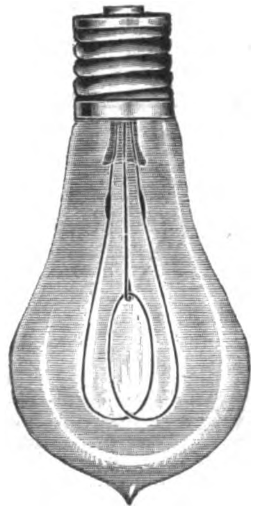

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